THE DEVELOPMENT OF ARCHITECTURAL ART FROM STRUCTURAL REQUIREMENTS AND NATURE OF MATERIALS.

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VITRUVIUS in his chapter on the origin of buildings sums up in a few words the development of architectural art. He tells us that in ancient times men, like wild beasts, lived in forests, caves, and groves, where they made shelters under which they might lie, and by observing each other's work and turning their thoughts to discover something new they by degrees improved and made a better kind of habitation. Then when their minds were thus enlightened, and they became more judicious by experience, they no longer built huts but founded houses, with walls constructed of bricks, stones, or other materials; and, observing also that nature afforded a great variety of timber and other materials fit for building, they availed themselves of that advantage, and thus improving in the arts they extended them to increase the pleasures and elegancies of life.

Here we have all the historical facts marshalled in due order, and the whole development of architectural art traced in a few lines.

A structural requirement produced the first shelter for primitive man, and it is the variableness of structural requirement that creates modifications in architecture. No great development has taken place prompted purely by a desire to do something new. Architecture results, in the first instance, from necessity, and can progress only so long as new wants create new materials or new methods of handling existing materials. The one-storied brick hut of pra-dynastic Egypt is the tangible expression of a want satisfied. So is the thirty-two-storied steel skeleton block of present-day America. The difference in these two extremes is due to the difference in the requirements experienced by races divided by eighty centuries.

Then primitive man observed his neighbour, tried to improve on his methods, and so to make another and a better kind of habitation. Thus it is that architecture has advanced throughout the ages. Man, having studied past methods of construction, keeps those which answer his requirements and invents new methods to meet new necessities. These new methods of treatment revolutionise the art and form the basis of what is afterwards classified as a style. For example, the Roman and modern styles of building are alike in this, that

the visible architecture is often only the covering of the constructional material beneath. In modern buildings the new material, steel, meets modern requirements, whereas in Rome solid concrete answered the purpose. How far convenience, common-sense, and cost justify the use of steel in connection with architecture is for the individual to decide.

Primitive man further extended the art by availing himself of the advantage offered by Nature in the great variety of material she provides. On looking back over eighty centuries we appreciate how dependent architecture is on material. It is not only a variety of materials that produces a variety of styles. The same material applied with a greater appreciation of its qualities will produce different forms which mark the progress of the art. Thus the varieties of material—granite, clay, marble, cement, stone, brick, and steel—have produced the Egyptian, Assyrian, Greek, Roman, Gothic, Renaissance and modern styles, while the difference between two consecutive stone styles, Romanesque and Gothic, is due to the fact that the Gothic builder appreciated the qualities of the material and made his stone work to the limit of its endurance, whereas the Romanesque builder only required his stone to do a fractional amount of the work of which it was capable.

Thus we see that although architecture is partly the work of tradition and imagination, it owes its chief developments to the requirements of succeeding ages and local necessities, and to the nature and peculiarities of material in given countries.

The term "structural requirement" is so comprehensive that it will be well to define here what is understood by it, and thus to sketch the lines on which the development of architectural art will be traced.

Architectural composition can be divided into four sections, and includes the arrangement of the plan, the construction of the walls, the roofing of the space enclosed, and the finish conferred by mouldings and ornament. Each of these sections is governed by some necessity, some requirement, and it is in fulfilling these requirements that architectural art develops itself.

Plan.—The plan is the suitable disposition of spaces. It varies not only with the different uses of buildings, but with the habits of the race during the period at which it was evolved. Thus the plan of the Roman Senate House consisted of a rectangular space, about 90 by 60 feet, surrounded by four walls, and supplying the needs of those times. The English Senate House, one of the most original architectural conceptions ancient or modern, stands on an area of 8 acres, and contains 500 rooms, devoted to nearly as many purposes. It illustrates how the question of plan is essentially the basis of modern architecture, because modern buildings are more intricate in their purpose and requirements than are ancient buildings. It is the structural requirement of the age which produced this development. The nature of material also affects the plan to an important extent and hampers the architect, till in self-defence he has to change his methods or introduce new materials. One of the chief aims in a plan is to make the voids as large and the solids as small as possible; or, in other words, to obtain the largest available floor space consistent with stability; and the proportion between these two areas varies with the material employed. The Egyptian mud brick required walls of such a thickness that the solid exceeded the void space. The use of dressed stone turned the balance in favour of the voids, which in Milan Cathedral bear the proportion of 10 to 1; and the use of steel in modern buildings has infinitely increased this proportion.

Wall.—The construction of the walls is merely the projecting upwards of the plan, and is governed by the same necessities as dictated the plan. When population is scanty and land abundant, as in many country districts, one-storied houses, built of rubble, fulfil the requirement. But when land is valued at 60*l.* the square foot, as in New York, and 1,700 persons

must be provided with office room on an area of 8,000 square feet, then the wall construction must change, and such methods be adopted as will allow of the walls to tower 300 feet in the air. In ancient trabeated construction the openings in a wall, except of small dimensions, were a source of weakness, for stone lintels are liable to fracture under a transverse strain; but in modern constructions, where much light is required to penetrate the wall, the steel girder, fifteen times as strong as the stone lintel, does away with the element of danger and supplies a structural requirement.

Roof.—The roofing of spaces again develops with the need of the builder. Trabeated construction in stone or wood could only satisfy requirements so long as the spaces to be roofed over were small. Vast halls, like Roman baths and palaces, necessitated the adoption of vaults whose spans were practically limitless. Subsequently, in comparatively small buildings, the wooden roof was rejected in favour of the vault, whose more durable material lessened the danger from fire. Here, again, do we see how structural requirement and nature of material caused the development of the roof.

Ornament.—Mouldings and ornament would hardly seem to result from a structural necessity, but that man is never long satisfied with the mere beauty of fitness and utility. The æsthetic portion of his nature demands a finish which is not necessarily utilitarian. But in good art this finish is so incorporated with construction that it is hard to separate the two. The construction of roofs, gutters, openings, and supports, affords opportunities for decoration, and hence we may say that the ornament belonging to any particular development of architecture is also the result of structural requirement.

How much the treatment is influenced by the nature of the material is to be seen by comparing the rare, stiff mouldings, the slight incisions, of Egyptian granite with the numerous full curves and round modelling of Gothic stone, or with the exuberant, fussy productions of easily moulded terra-cotta.

The development of architecture, depending therefore on new wants and fresh material, may be traced through five great groups of building, each distinguished by its own method of construction.

1. Egyptian, Western Asiatic and Greek, with trabeated construction.
2. Roman, with cast construction.
3. Byzantine, Romanesque, and Gothic, with arcuated construction.
4. Renaissance, with arch and lintel construction.
5. Modern, with steel trabeated construction.

Egypt.

It appears strange that although architecture is such a personal art, and arose in the first instance merely from a desire for shelter, the oldest surviving examples which are to be found in Egypt were not erected as habitations for man. Egyptian architecture shows less than any other the characteristics of structural requirements and the influence of material. Its scope was extremely limited, and the one quality it aimed at was endurance. It was mainly influenced by another powerful factor which affects fine arts, the religious polity of the people.

Tombs and temples precede secular buildings. The primitive material, mud and wattle, is considered sufficient for the huts of the living long after stone sepulchres are being provided for the dead; and these same stupendous sepulchres, though they hardly come within any of the accepted definitions of architecture, rank among the noblest monuments this art has handed down.

Art, as the gratification of an artificial taste and standard, was at that time scarcely in existence. The primitive Egyptian had no precedent to work on, nothing but nature from which to draw inspiration—a nature consisting of bare expanses of flat sand with occasional hillocks to break the monotony. But these hillocks were a source of inspiration, and the builder set himself to supplement, to imitate, to rival the works of nature. He did not regard his work as a building up of brick or stone. He ignored the capabilities of his material and recognised only one requirement, solidity and stability from mass: and he only indirectly acknowledged this by a desire to rival nature in the erection of masses. He imitated in so far as he worked on the same lines as nature, and it is owing to this highest and most difficult kind of imitation that the Pyramids are included among monuments of architecture.

Thus a building was an artificial hill in which chambers were constructed after it had been piled together. A mere hollow was left where the chamber was to be found eventually, and then it was dressed down and sculptured as if it were in the heart of the live rock. Mass was the first feature made use of, and being the easiest way of imposing beholders shows the efforts of a rude nation striving to produce effect. Even when the Egyptian adopted megalithism for his religious monuments he adhered to his soft-brick methods. The tumulus of brick had been of large dimensions to ensure resistance to time and weather, and the granite tumulus should be as large.

We said Egyptian architecture was restricted in scope. It has handed down two important groups of buildings—tombs and temples—both of which exhibit the same characteristics.

Plan.—The plan of a pyramid was elementary, consisting of a chamber and passages within a square mass of walling. Simplicity was likewise the chief feature in the plan of the temple. It was merely a hall or a collection of halls leading one out of the other, without any accessories or adjuncts. It typifies the condition of a simple people.

Wall.—The construction of the walls is characterised by stability and durability. They were built for eternity, and leave an impression of simplicity and grandeur.

Roof.—The roof, being composed of slabs of stone, materially restricted the conception of the plan. For as soon as the interval between the supports exceeds the dimensions of the stones it is subdivided by a row of pillars carrying stone beams on which rests the ceiling.

Ornament.—Just as in the construction the nature of the material did not palpably affect the method of building, so in the decoration we find that wood transmitted its forms to stone. The granite column resembles a bundle of reeds; the granite cornice takes the form of the bending papyrus grass. The chief principle of the decoration is the most powerful one architecture possesses, and being the simplest is characteristic of a simple, primitive people: this method is repetition and symmetry. We find everywhere rows of columns, avenues of sphinxes, processions of statues, all in the same position, and a limited number of conventional types painted or carved in stiff bands.

The resisting nature of the material is certainly accountable for the few hard mouldings that occur and for the slight incision of carved ornament. This enforced absence of mouldings and projecting features left the wall surface plain for the quantity of colour decoration applied by the Egyptian. The granite of the walls and ceilings was plastered and painted in a free, vigorous style which shows the Egyptian to have been no less a draughtsman than a colourist. The earliest ornament is merely a zigzag line found 4000 B.C. Gradually delicate flowing conventional ornament was introduced, and later representations of flowers, fruit, animals, and the human figure occur, introduced as symbols.

Wall surfaces were also covered with tiles, either modelled or painted in brilliant colours. A rough sort of mosaic was also used consisting of a ground of white limestone or earthenware incrusted with brilliantly coloured bits of glass.

The Egyptian just used the means he had at hand. He sought neither inspiration nor material in foreign countries, and has by simple methods produced an architecture which in its massive construction and symbolical decoration records the mental needs of his age.

Western Asia.

The extensive ruins of mighty cities attest to the high degree of prosperity and civilisation reached in early times by the inhabitants of Western Asia. The character both of Chaldean and Assyrian architecture is the same. It consists of a system of construction resting on the use of clay. In Chaldea this is the result of necessity, whereas in Assyria it is the result of tradition.

In the fertile plain of Chaldea the want of stone was acutely felt. The only building material was clay, which was turned into the more convenient medium, brick. "Go to," said the builders of Babel, "let us make brick, and burn them throughly. And they had brick for stone, and slime had they for mortar." Had it been possible to "burn them throughly," these bricks would have lasted longer, and walls would not have been reduced to their present shapeless masses. But wood was rare and fuel costly, so that the builders had to content themselves for the most part with sun-dried bricks, using the kiln-dried brick as a skin or covering.

Centuries later, when the empire was transferred from the mother country to its offshoot Assyria, the Assyrian architects proved such servile pupils of the old masters of Chaldea that they never willingly used stone, although their acquaintance with the foreign art of Tyre, Memphis, and Thebes must have shown them the advantage of this material. The Assyrian argued that the plans of his ancestor were good enough for him, and so was the material—with the result that the art made no sensible advance, and Assyrian architecture is merely a reproduction, partially in stone, of Chaldean brick structures.

In Egypt it is the tomb, the habitation of the dead, that is built for eternity in stone and granite, while the habitation of the living is built of less durable material. In Western Asia the requirements of the living are of greater importance, and the palace is the chief building. We find no monumental hypogea, for no mountains of stone existed soft enough to allow of galleries being hewn, or hard enough to prevent chambers once hewn from crumbling. The tomb like the palace is built of brick, but not so solidly, and consequently it has crumbled more.

Because brick is used as the constructional material, and sculptured stone as an outer covering, Assyrian architecture is accused of externalism and unreality. This criticism is hardly fair, for the Assyrian was hampered in many ways. Tradition is a far more powerful factor in the East than the West. Out there "Custom hangs with a weight heavy as frost and deep almost as life," and to alter ancient methods would have been an act of impiety. Again, although stone was procurable, it had to be brought from a distance, and required skilled labour for its handling, whereas the local material, clay, could be worked by slave labour. Therefore the Assyrian used clay, and for the most part had to content himself with sun-dried bricks. The only effect one could hope to produce by such a mean material was an effect of mass. The palace, the important building of the town, was raised on a hillock of brickwork, so that the foot of its walls stands far above the surrounding roofs. This elevated position both typified the superiority of the sovereign over his subjects and ensured his safety when the city had fallen into the hands of the enemy.

Plan.—In the plan we see a distinct advance on Egyptian work. The spaces are not

strung together like independent buildings; they are grouped according to the purposes they serve. The public halls are easy of access; the women's apartments difficult of approach, the offices suitably disposed. The whole arrangement shows an anticipation of human needs and a regard for creature comfort as then understood.

Wall.—In construction the palace was nothing but a great compact block of earth containing a series of small covered-in rooms, large uncovered halls, and courtyards for supplying light. The walls were of immense thickness, which served the double purpose of keeping both heat and enemies at a distance. The next step in the building was as much constructive as decorative. The friable edges of the brick exposed to the atmosphere and to rough usage, required to be protected in some way, so the clay walls were coated with enamelled tiles and with slabs of stone of such tremendous size—12 feet square—that this alone would betray that they are a veneer and not an integral part of the building. On the external walls there is not a feature that might be called a moulding. No cornice, no projection. But the crowning ornament, a crenellation of baked bricks, was derived essentially from the method of brick building. A series of little piers forming a festoon, so to say, against the sky would be the natural termination to a building consisting of such small materials.

Roof.—The roof was most important, conferring a special character on the building and showing a great development on the Egyptian manner of roofing. Vaults entered into the composition alike of great and small buildings. The one-storied house, without window or feature to break the monotony of the wall, was protected by a terraced roof surmounted by a conical dome. The primitive dome was not a vault construction. It was built on the corbelling-out system, which has the advantage of not requiring wood centering. Hence the dome is the usual type of Eastern vaulting, and was derived from a structural requirement and from the absence of a material, wood.

Ornament.—It may seem strange that no mouldings should be found in a clay country, where the material offers such facilities to the modeller. One reason has already been adduced—the builders would not incur the needless expense of baking purely ornamental features. Another reason for their non-existence is the absence of a *raison d'être*. The object of moulding a surface is to increase the expression of an architectural feature and to bring it into prominence. But an Assyrian building had practically no features; that is, it did not express externally its internal arrangements. The external wall was an unbroken solid mass, 20 feet thick, giving no sign of voids, sources of weakness within. Even on the internal walls no traces remain of window openings, which probably did not exist. Doorways there necessarily were; but these were of narrow limits, and made as unobtrusive as possible, being regarded in the light of barriers, not of entrances.

Although mouldings were absent, there was plenty of ornament, all structurally useful. Externally and internally in important places, such as gateways and royal apartments, the wall was protected to a considerable height by sculptured slabs of stone. Externally enamelled bricks, highly coloured, faced exposed surfaces, while internally the clay core was shielded by bas-reliefs in plaster painted in bright colours. Decorative motives were necessarily few at such an early period, but such as they were—rosette, guilloche, and honeysuckle—they have survived to the present day.

It is not to be wondered at that colour rather than form attracted the Assyrian. Colour is the easier to appreciate, and the Assyrian for all his comparative civilisation was a cruel barbarian at heart, and richly deserved that Nineveh and the rest of his land should be made "a desolation," as foretold by the prophet Zephaniah.

Etruria.

Etruscan work may be considered the connecting link between the architecture of the East and of the West. Very little of this art survives, and what there is shows more force than beauty, more vigour than grace, as is illustrated by the enormous piles of uncemented masonry which for three thousand years have withstood the ravages of time and man.

The little that remains, however, shows the debt that Western architecture owes to Etruria. The introduction of the arch into the system of building is the most prolific development ever accomplished in architecture, and it is to Etruria that Europe owes the arch.

It is improbable that the Etruscan discovered for himself the principle of the arch, for, although highly skilled in practice and technique, he was not original. The Phœnicians probably introduced into Etruria from Assyria the system of vaulting by corbels, and, considering the acknowledged skill and practical turn of the Etruscan, it seems likely that he worked out for himself the principle of cuneiform sustentation. The earliest perfect arched construction extant is the Cloaca Maxima, built in the sixth century B.C.; and its perfection leads one to suppose long previous acquaintance with this mode of construction.

Etruscan architecture is a curious mixture of Eastern and Western ideas. While Egypt and Greece clung to the lintel, Etruria adopted the Eastern arch. The origin of the Etruscan nation remains an enigma. Seneca says, "Asia claims the Etruscans as her own," and the strongest evidence seems to point to a Lydian origin. It is thanks to the Oriental custom of representing the abodes of the living in the receptacles of the dead that we can form an idea of what Etruscan temples and houses were like.

Plan.—In the earliest period of building these constructions were circular on plan—the natural form suggested by the material used, wattle. After the sixth century B.C. a change of material necessitated a change of plan.

Wall.—Wood replaced the frail wattle, and plans were made rectangular; for with the advance made in carpentry it was seen that of all plans the circular is the least adapted to a wooden construction. Vitruvius corroborates the supposition that temples were likewise only built of wood, for he represents the intercolumniations as so much wider than those of the Greeks that the epistylia must have been of wood.

Roof.—From the evidence of the tombs we gather that ceilings were built up of beams and rafters, and from the same source we learn that both inside and out the walls glowed with colour.

Again, we must look for that great development of Etruscan architecture, the arch, in the tombs, where we see that this form of building was forced on the Etruscan from his structural requirements and the nature of his material. The object of the Etruscan was to conceal his tomb, and consequently the leading feature of sepulchres is that they are subterranean. They are either hollowed out of the living rock, or, where no cliff is available, they are constructed of masonry and heaped over with earth. In this latter form the roofing would suggest a problem. The Etruscan had no granite, like the Egyptian, which he could throw lintel-wise from support to support, and so carry the superincumbent tumulus. The local stone, tufa, of volcanic origin, was not compact or strong enough to bear a transverse strain. But the facility of working it would naturally suggest small blocks which would build up the arch and stand the necessary compression.

And so it came to pass that a change of method revolutionised the art of building—that art in which no change takes place and endures that is not occasioned by necessity.

GREECE.

Although all Greek monuments are of trabeated construction, this form, involving great restrictions and limitations, was not forced on the Greek by ignorance of other methods. Traces of arched construction remain, dating from the most remote period of Greek history. In the monuments of Acarnania can be followed the successive stages by which the arch was reached. We find the jambs of a gateway corbelled out till they meet above in a rough sort of arch; then acutely pointed openings formed by two inclined slabs of stone, supporting each other; then a door-head, composed of two cantilevers with a semicircular piece cut away where the stones butt; and lastly we find the turned arch with radiating voussoirs and keystone complete.

Not only were openings in walls built on the arched system: entire monuments, such as the Treasury of Atreus, dating from the tenth century B.C., were of domical construction, although built with corbels. Thus we see that it was only the strong preference for a rectilineal architecture which relegated arched construction to the background and admitted of its practice only in structures of utilitarian purpose.

In the same way the Greek understood perfectly the handling of crude brick as a building material, but as a rule he ignored it in his monumental constructions. Vitruvius in his chapter on "the sorts of walls used by the Greeks" certainly enumerates some important buildings constructed of brick, including a temple and a palace at Tralles. "Even the mausoleum of the most potent king of Halicarnassus, in which, though the ornaments were all of Proconnesian marble, the walls were built of bricks, which remain to this time exceedingly substantial. . . . Nor was it to avoid expense that the king used bricks . . . but it was the result of his judgment and knowledge in building."

Hence we see that these restrictions of form and material were self-imposed by the Greek, and no doubt brought about such rare perfection in his art, just as submission to the severest rules in harmony has led to the highest inspirations of great composers.

The theory advanced by Vitruvius, that Greek art had its origin in a wood construction, appears to be borne out by facts, in spite of Hübsch's endeavours to prove that a stone construction was the basis of the style. It is true that as the art advanced it grew lighter and more graceful, and consequently approached towards, rather than receded from, wood proportions. It is also true that a style created by a material does not long survive its disuse, and the Greek stone style has survived twenty-six centuries. But so much in the early Doric order is unjustifiable from a stonecutter's point of view that the forms must be a survival of older methods of construction. For example, at Agrigentum, the great columns are embedded in the wall, and the carrying member, the architrave, is itself carried by the partition wall. At Pæstum the joints of the cornice fall at random, often in the middle of a mutule; the metopes and triglyphs, instead of being placed independently in position, are often carved out of the same block, and instead of being a single stone in height they are built up of two courses of masonry. Altogether this meaningless subdivision into metopes and triglyphs shows that the Doric frieze is manifestly a type which has survived its functions. The Greek was quick to recognise this, and, in his practical way of renouncing tradition when a better method suggested itself in the Ionic order, he reduced the frieze to a continuous band dividing two moulded surfaces. The fact that the Doric and Ionic orders were used contemporaneously shows that they were independent developments from a common stock. The sturdy proportions of the Doric order recall the large scantlings obtainable from the forests of Thrace, and the slighter proportions of the Ionic order recall the frail constructions of Ionia, where wood is scarce.

Although Greek architecture thus evidently originated from a wooden construction, the

Greek was far too reasonable to let the qualities of another material permanently influence and prejudice his design for stone. After a period of groping for the right method his architecture resulted from reasoned construction.

Plan.—Problems were approached in a frank, simple way, and plans were provided which had about them none of the mystery of the Egyptian pyramid, nor the precaution of the Asiatic palace. The plan of the typical Greek building the temple, symbolical of Greek devotion and superstition, is developed on strict lines of necessity governed by the possibilities inherent in stone. The cella contains one feature, a doorway. A natural advance emphasises this doorway by a portico. Love for symmetry added a portico at the rear. Then followed the obvious connection of the porticoes by a colonnade, which, being roofed over, supplied shelter and shade for worshippers. A double peristyle to a large temple not only added to the importance of its appearance, but provided shelter for increased numbers. The peristyle having originated from a structural necessity, its appearance was governed by the nature of the material, the columns being of such a size and spaced at such intervals as the nature of the stone employed permitted.

Wall.—The chief characteristic of Greek architecture is the simplicity, not only of plan, but of construction. The early Greek temple was a crude brick cella fronted by a portico of wooden columns. To prevent the damp from rising in the soft brick, the wall was raised on a high stone plinth, and this feature survives in the latest stone and marble constructions in the form of a course of masonry much deeper than the remaining courses in the wall. All brick and stone temples were plastered with fine cement made of pounded marble, which formed a hard skin and prevented injury from the atmosphere; at the same time it provided a suitable ground on which the painter could lay his colour decoration.

From the fifth century B.C. marble itself became the building material, and henceforward construction and art are one. The structural requirements supply the outward form and constitute the style. Every member is apparent and assumes the form most suited to the function which it fulfils. The important support, the column, springs erect and straight from the ground: it was left to future ages to contort and twist the shaft into the semblance of a corkscrew. In the Greek column the idea of resistance to a vertical pressure is emphasised by numerous vertical channels, so that instead of seeing only the two boundary lines of the shaft the eye sees a number of vertical lines running up to support the architrave, and is satisfied that the column is equal to its load. These flutes further fulfil the æsthetic object of cutting up the surface into ridges which catch the light, and channels which fill with shadow. Every feature and every moulding is designed with the same regard for fitness and beauty, from the base of the Ionic column rounded so as not to present obstructing angles, up to the cornice channelled for the carriage and discharge of water. Refinement in details is carried to such an extent that every vertical member is inclined, every horizontal member deflected, in order to correct optical delusions, and thus reality is sacrificed to obtain the appearance of reality.

Roof.—The roof was constructed of wood framing covered with marble tiles. Since the horizontal line was the predominating feature of the design, the roof was inclined at the lowest pitch at which the tile would throw off water. It influenced the plan to this extent, that if the cella were of such a width as could not be spanned by a single beam, one or two rows of columns were introduced into the plan for the purpose of supporting the beams where they butted. The extremities of the roof terminated in stone pediments—a Greek invention which, simple as it may seem, developed centuries later into the magnificent high-pitch gables of the Gothic period.

Ornament.—Greek ornament is so involved in the construction that it is hard to consider

it apart. It is now an accepted fact that a large quantity of colour decoration was used on the many plain surfaces of the Doric order. But paint is perishable; and when once the ornament, an inherent part of the design, is destroyed, the effect aimed at by the Greek is destroyed also. It occurred to him to perpetuate his detail by using the chisel instead of the brush; and so, although the ornament of the Doric order has mostly disappeared, the later Ionic and Corinthian orders have handed down through the centuries their matchless decoration.

The nature of the fine, compact, white marble, together with the brilliant sunlight which shows up the least modelling, is responsible for the very delicate curves of Greek mouldings. And this same beautiful material, unrivalled for a sculptor's work, would naturally tempt the Greek lover of form to introduce as much figure sculpture as possible into the design of a building.

So few remains exist, other than those of temples, that but little is known of the civil architecture of Greece. As far as one can judge from propylea, basilica, and public monument, civil structures all resembled temples outwardly. The only authority recognised by the Greek at the period of the greatest expansion of art was the authority of the gods. Since religious polity was pre-eminent, and swayed the tendency of architecture, we cannot wonder that the civil buildings all took upon themselves the characteristics proper to, and the outcome of, the structural requirements of temple architecture.

Rome.

Vitruvius in his definition of architecture states that it consists of ordination, disposition, eurythmy, decor, and distribution. Distribution, he goes on to say, consists in the proper dispensation and application of the materials, and in adapting the building to the convenience of the owner and to its destination.

Of all ancient styles the Roman illustrates most aptly this definition of the great Roman architect. But little was conceded to tradition or to appearance. The development of Roman architecture was occasioned by the local requirements and by the nature of local materials. For this reason it should perhaps be spoken of in the plural, for it presents different aspects and methods according to the land in which we find it. Roman architecture does not signify a single art, any more than the Roman Empire signified a single nation. We have in it a collection of architectures on which the central authority impresses a common tendency, but which each keeps its local characteristics. Rome, being the centre of political sway, was also the centre of the chief development in art, and it is there that we will consider it.

The scanty remains of regal and republican times, rendered thus scanty by frequent fires and wholesale rebuilding under the emperors, show that the early Romans had no art of their own. The sixth-century city wall of Servius Tullius and the traces of early republican temples and houses on the Palatine are Etruscan in their use of rectangular tufa blocks, raised in alternate courses of headers and stretchers, and in the construction of their arched doorways. The ruling classes in early Rome were Etruscan, and they naturally adhered to their own manner of building. Thus in temples with a peristyle the columns are so widely spaced that the lintels must have been of wood, and Vitruvius mentions that their pediments were "adorned with statues of terra-cotta in the Etruscan fashion."

Then in late republican and early imperial times Rome looked to Greece for artistic inspiration. The impulse was given by the Roman conquests in the third century B.C. of Magna Græcia, Sicily, and Corinth. That this taste was a passing fashion and not innate is illustrated by the well-known story told of the consul Lucius Mummius.

Genuine Roman architecture dates from imperial times, when the utilitarian spirit of the nation led naturally and easily to the development of this new style, which is great without effort, stupendous without exaggeration.

It would be a nice question to determine whether the supply of a new material, concrete, created the demand for new requirements in structures, or whether the necessity for such structures suggested the use of concrete. Concrete was certainly known for centuries before it became the leading building material, but the Roman was slow to appreciate its value. It is amusing to note the extreme caution with which it is first used and the reckless daring of its later application. For instance, in prehistoric times thick beds of it formed floors only on the ground level; in imperial times a 14-inch floor would span a bearing of 20 feet without any intermediate support—a feat even more daring than the 80 feet vaulted spans of larger buildings.

On the whole one might be tempted to say that the material had a larger share than the structural requirements in developing the style, for most of the buildings on which concrete was used, *i.e.* palaces, theatres, baths, temples, and basilicas, existed in Greek days. But in Greece no palace towered like the Septizonium of Severus, 210 feet in the air; no theatre approached in area the five acres of Titus' amphitheatre; no stadium accommodated the 485,000 spectators of the Circus Maximus; no bath was ceiled like Diocletian's at a height of 140 feet; no temple was spanned by a lintel 142 feet long. And all this was made possible in Rome through the presence of pozzolana volcanic earth, which mixed with lime forms a cement of extreme strength, and has contributed more than any other material to make Rome the "Eternal City."

The Romans were not driven to the use of concrete because of the want of other material. They had on the spot stone of every quality, from soft tufa, worked in the prehistoric period with bronze tools, to the hardest travertine, a pure carbonate of lime. An intermediate quality, peperino, was largely used, being a volcanic stone of great durability and invaluable in its powers of resisting fire. Sand and gravel abounded, of excellent quality for the manufacture of mortar, and clay for the making of bricks. Yet all these materials were ignored in the constructional parts of a building, and were used merely as a facing to the concrete core.

The reason of this is apparent. The first condition in a Roman design was that it should be capable of being executed by unskilled labour, and concrete being easily worked fulfilled this requirement. The state of ancient Roman society imposed this condition. Towards the end of the republic only two classes existed on Latin territory, officials and slaves. The former were occupied with matters of state and war, and the majority of the slaves were untrained in the art of building. Therefore the Roman architect adopted a form of construction which was within the reach of unskilled workmen.

Roman architecture is often described as the result of arcuated construction. However, its main characteristic is not the development of the principle of the arch, but the extensive and skilful use of concrete. The arch is a method of sustaining material over voids by a system of mutual compression. But the Roman arch in the majority of cases is not exposed to compression. It is cast in a solid mass, and exerts no lateral thrust; wherefore it only bears the form, not the nature, of an arch, which, according to the Hindoo saying, "never sleeps."

The development of Roman architecture is, then, the history of concrete. At first this was used timidly on the ground floor as a filling-in between the solid masonry below the walls and columns of the Roman-Greek temple. Then from the first century B.C. it became the chief material for independent walls, and its aggregate is often an indication of the period to which it belongs. Thus broken lumps of tufa were used up to the time of Julius Cæsar;

under the empire broken brick and travertine were used as well as tufa and peperino, while in later imperial restorations great quantities of fire-stained marble are found as well as other materials.

The material with which concrete is faced is another indication of its age. Why facing should ever have been used is a matter of debate, for, whether this consisted of the rough opus incertum of the first century B.C., the neat opus reticulatum of the first and second centuries A.D., the exquisite brickwork of the first, second, and third centuries, or the opus mixtum of later times, it was none of it meant to be seen, and was quite unnecessary as a protection to the core.

Though the Roman was satisfied with a rough material for all practical purposes of building, his love of pomp and display demanded an appearance which this material by its nature could not supply. Concrete construction does not lend itself to artistic expression, and hence the concrete body had to be encased on the exterior with stone, marble, or stucco; on the interior with marble panelling, mosaic, or painting. For this reason Roman architecture is accused of being deceptive, and is compared unfavourably with its Greek model; for in Greek work form is construction, whereas in Roman work form hides construction. But it should be borne in mind that magnitude determines the use to which a material should be put; and whereas in buildings of limited dimensions, like those of the Greeks, we should expect marble to be used throughout the structure, in the vast constructions of the Romans it is a foregone conclusion that the decoration is only a veneer. Where common-sense excludes delusion, there can be no question of fraud.

The more closely we examine Roman buildings, the more clearly do we perceive that their architecture was the product of necessity and imagination. Necessity taught the Roman to meet new requirements, imagination led him to adopt a new material, and to adapt the old materials and methods of construction to suit the nature of concrete.

Temple.—Augustus records in the Ancyrean inscription: "During my sixth consulship I restored eighty-two temples to the gods," and he built others. Although from this statement and from existing remains we see that temples were very numerous in Rome, of all the different groups of buildings they are perhaps the least characteristic of Roman architecture. The Roman borrowed his temple, like his religion, from Greece, and found them well suited to his requirements. However, with time important changes were made which were the result of structural necessity and the nature of the material.

Plan.—Roman temples were not only dwellings for deities, they were used as museums of sculpture and as picture galleries. Consequently we see that on plan the tendency was to increase the size of the cella, either by making the temple wider in proportion to its length than a Greek temple would have been, as in the temple of Castor and Pollux, or by sacrificing the peristyle and building a large cella with prostyle portico and engaged columns along its walls, as in the temple of Fortuna Virilis. From the secondary use to which these buildings were put, we see that the modern designs for museum and picture gallery on the lines of a heathen temple have good precedent to work on, and are not such acts of incongruity as critics are wont to imply.

Wall.—For the same reason that more floor space was required, more light was necessary, *i.e.* to show up the art treasures. Greek temples were dark, being lighted artificially or from the roof. Roman temples have large windows inserted in their walls, which were filled in with bronze screens or with pierced and glazed marble slabs. But even when in style and detail the design was almost pure Greek, as in the temple of Castor and Pollux, the Roman did not hesitate to introduce a foreign constructional peculiarity. He was always timid in the use of lintels, and in this temple we find the frieze, instead of being in long lengths, is built up to

form a series of arches which throw the weight of the cornice and roof directly on to the columns.

Roof.—It was again the presence of art treasures that caused a change in the manner of roofing temples. Wooden ceilings were a source of danger in Rome, where fires were frequent, and it was important to make the museums fireproof. Hence we find instances of concrete vaults thrown from wall to wall, enriched with deep sunk coffers decorated with stucco mouldings and rosettes, all richly gilt and painted. The vaults over the two apses of the temple of Venus and Rome, dating from Hadrian, are some of the finest examples existing of the kind. The greatest of all vaulted temples is the vast domed Pantheon, also of Hadrian, which, with its diameter of over 142 feet and its one great top-light, constitutes one of the stateliest of existing buildings.

Ornament.—In architectural detail we see Roman work at its worst. At first the Roman was content to make accurate copies of Greek mouldings and enrichments. But the sections of mouldings were soon modified from delicate hand-drawn curves to coarse compass-drawn rounds and hollows, and the craving for richness of effect finally led to an elaborate surface ornament which overran every available space, and by its excessive use dragged art down to the lowest depths of degradation. The use of a rough-grained stone like travertine was partly the cause of the coarsening of ornament, and the broader treatment required by the stone spread unconsciously to marble.

House.—Vitruvius when treating of houses gives a striking example how Roman architecture was developed from structural requirement and the nature of material. He says: "Brick (*i.e.* sun-dried) cannot be used by Romans within the city. The law permits no walls which are built in public places to be of greater thickness than one foot and a half; but brick one and a half feet thick cannot sustain more than one story, yet . . . the multitude of citizens requiring innumerable habitations, and as the area of the city cannot contain so great a number as inhabit it, to remedy the deficiency the height of buildings is increased. To this end, the walls are raised with hewn stone, testaceous substances or rubble, and built many stories high."

Thus we see how the Building Act of Augustus, by limiting the thickness of supporting walls, caused the crude brick and wood of republican times to disappear, and provided for more durable and safer habitations. The harder nature of stone and concrete allowed of the buildings being carried up to a greater height and provided more accommodation in an overpopulated district. Indeed, the height seems at times to have been excessive, for we find Trajan passing a law that no house in a street should exceed 60 feet in height.

Plan.—To judge from the Greek names of the different apartments in a Roman private house, it appears the plan of the dwelling as well as that of the temple was taken from Greece.

Wall.—But whereas in a Greek house the windows all looked out on to an enclosed courtyard, one gathers from a fourth-century mosaic found in Algeria that the Roman dwelling resembled a modern palazzo. That is, the ground floor had a few openings heavily grated, and the principal rooms on the first floor were lighted with numerous arched windows. The walls were built of concrete faced with brick, never of brick alone. So general was the exclusion of brick as a constructional medium that even partition walls, seven inches thick, were cast in concrete and faced both sides with bricks; an operation that must have entailed much labour.

Roof.—From the evidence of oft-repeated fires it seems natural to conclude that the roofs of most buildings in Rome were of timber. In the few examples that remain of the upper stories of houses we find traces of the travertine corbels that carried the wooden

ceilings ; also remains of concrete ceilings either vaulted or flat, spanning the room like a great slab of stone.

Ornament.—The decorations were richer than the austere Greek would have tolerated in a private dwelling. Concrete being wholly inimical to artistic expression, but presenting large flat areas suitable for mosaic work, we find this medium largely used. In the houses of wealthy Romans the pavements were remarkable for the intricacy of their designs in mosaic, executed in varieties of coloured marbles imported from every part of the Empire. The walls were covered with elaborate mosaics of pictorial style, executed with minute tesseræ of brilliantly coloured paste or glass. The vaults were also decorated with glass mosaic. Or wall and vault were covered with stucco, which formed an excellent field for painting in fresco, tempera, varnish pigments, or encaustic. Another usual way of decorating walls was to line them with marble, or, where expense was considered, a fine hard stucco was made of pounded marble, whose surface was highly polished and divided up with sunk lines to imitate marble blocks.

Theatres.—The Roman Forum was in early times the chief public resort. It was here that wooden theatres, temporary erections, were first set up. As time went on and population increased, the limits of the Forum became too small for all the business transacted there. Consequently the theatre had to be moved to a roomier site. Still the stern republic was so fearful of introducing Greek luxury that it prohibited a stone construction. It was not till the close of the republic that the hideous accidents resulting from erections of shaky platforms and seats and the increasing demand for accommodation led to the building of permanent theatres. The first stone one built by Pompey was opened 55 B.C. : it seated 40,000 people, and was still in use in the sixth century.

Plan.—On plan the Roman theatre was simply a copy of the Greek theatre modified in the proportion of the stage. Vitruvius describes the differences minutely, and closes his instructions with the wholesome advice to consult convenience when other things interfere with the symmetry.

Wall.—The main difference between the Greek theatre and the Roman was in the construction. The Greek usually selected a hill side in which he excavated the tiers of seats. The Roman built on level ground and made the necessary slope with raking vaults of concrete. Thus we see that material and method of construction made the Roman independent of site and natural advantages.

Amphitheatres.—The Greek theatre was designed for literary entertainment only. The first stone Roman theatre was baptized with blood, and its opening celebrated with a butchery of wild beasts. The mimic sorrows and artificial tragedies of the Greek stage were too tame for the brutal Roman. He must witness pain in agonising reality and death in all its horror before he can be moved. Although for singing and dramatic representations the performers must face the audience, this is not necessary in combats among men and beasts. The theatre plan excluded one half of the possible number of spectators, and hence the oval plan or amphitheatre was adopted for these shows. The amphitheatre is a purely Roman invention, and arose from the unhealthy craving for stimulating excitement.

Plan.—That the amphitheatre was the outcome of doubling the theatre is shown by Pliny's description of an astonishing building dating from 50 B.C. Two large wooden theatres were built on pivots, back to back, so that on occasions they could be swung round and form an amphitheatre. Since these erections accommodated twice as many spectators as a theatre, the accidents that occurred through the breaking down of these temporary wooden structures were on a terrific scale. Tacitus mentions one in the first years of the first century in which the number of victims amounted to 50,000.

Wall.—Therefore the builders of the Colosseum, when they were required to seat 87,000 spectators, were driven by necessity to use stable materials, viz. stone and concrete. The method of construction, tiers of vaulted intersecting passages, connected by numerous staircases, provided the rapid means of dispersal which makes this building such a masterpiece of planning.

Thermæ.—This institution and its customs were of Greek origin, as is betrayed by the fact that the different apartments had Greek names according to the use to which they were put.

Plan.—The Roman emperors, however, so amplified and improved the plan of the thermæ that the list of rooms given by Vitruvius as finding place in a Greek bath is not sufficient to account for all the apartments in the imperial buildings. Whereas the Greek bath was built in connection with the Palestra, and was part of a scheme, the Roman bath itself was the scheme, which included many adjuncts. Architecturally these thermæ formed by far the largest and most magnificent of all the public buildings in Rome. Bulwer Lytton describes them thus: "Imagine every entertainment for mind and body; enumerate all the gymnastic games our fathers invented; repeat all the books Italy and Greece have produced; suppose places for all these games, admirers for all these works; add to this baths of the vastest size, the most complicated combination; intersperse the whole with gardens, with theatres, with porticoes, with schools; suppose in one word a city of the gods, composed but of palaces and public edifices, and you may form some faint idea of the glories of the great baths of Rome."

Wall.—These glories are chiefly due to the use of concrete. No other buildings exemplify the possibilities of this material to the same extent as do the thermæ. In them we see the most daring feats of construction, the most complete mastery over material. In gazing on these giant ruins we regret neither the marble, the mosaic, the painting, nor the sculpture that once formed their decoration. Imposing as this must have been, the real distinction of the design lay in the grandeur of its conception and the stateliness of its mass, and this still remains. The walls tower an immense height in the air, and bear vaults spacious as they are light. It is in the tepidarium of Diocletian's Baths that we find one of the most impressive interiors in the world—a vast hall, 200 feet long, spanned by a giant vault, 80 feet wide, divided into three bays and carried on eight points of support. It is in the laconicum of the Baths of Caracalla, an immense circular hall 116 feet in diameter, that but for earthquakes we should find a dome almost rivalling that of the Pantheon itself.

Roof.—These vaults were the result of necessity in apartments exposed to steam and hot air. The wood of the ceilings soon became injured, and before the introduction of vaults the most elaborate system of ceiling was resorted to. Vitruvius describes how tiles two feet square were suspended on iron hooks fixed to the floor above, and how these tiles were made impervious to damp by being coated with cement made of powdered white marble.

Circus.—The Roman circus is again the adaptation of the Greek stadium; but whereas the stadium was used for foot races, the circus was meant for chariot racing, and was therefore on a larger scale. The history of the development of the circus is the same as that of all other Roman buildings, *i.e.* caused by necessity, as witnessed by the evolution of the Circus Maximus, the first and the largest circus in Rome. The valley between the Palatine and the Aventine was drained and fitted with wooden seats by Tarquinius Priscus, 605 B.C. The frequently recurring fires and demands for more accommodation resulted in a building which in the first century could seat 485,000 persons, and with its marbles, mosaics, statues, and bronzes must have been the most magnificent building in the world. A few feet of the concrete substructures of the seats is all that remains of this magnificence. *Sic transit gloria mundi!*

Tombs.—The two methods of interment, inhumation and cremation, were practised

simultaneously in Rome, and we consequently find two large classes of sepulchres—tombs and columbaria.

As a rule wealthy citizens were buried. The sarcophagus was deposited in an underground chamber, and the spot was marked by a small monument. Both monument and chamber were ornamented with marble and paintings on stucco.

The columbarium was the repository usually of the ashes of freedmen and slaves. It was a practical way of providing for the dead in a limited space, and was more generally used round Rome than elsewhere, because of the value of ground in the immediate neighbourhood of the city. One of the largest of the columbaria contained the ashes of 6,000 freedmen of Livia, together with those of their families. The columbarium, which was usually underground, was vaulted in concrete, and its sides were lined with the same material to keep out the damp. Dryness was necessary, because mosaics, stucco reliefs, and paintings were lavished on the interiors of these buildings. As the chambers were rarely seen, and then only by dim lamplight, their decoration refutes the charge so commonly brought against the Romans, *i.e.* that they built only for ostentation. Modern columbaria differ in many points from their Roman predecessors. They are built chiefly above ground; they are flooded with light, and are almost devoid of decoration; these modifications are all due to the practical and commercial requirements of modern people.

Basilica.—The Greek basilica furnished the name for the Roman building in which assemblies took place, but the resemblance between the prototype and the typical Roman development ceases at the name. Early basilicas are in such a ruinous condition that it is difficult to reconstruct them in imagination. Vitruvius advises that "basilicas should be adjoined to the Forum on the warmest side, that the merchants may confer together without being incommoded by the weather." From this it may be inferred that the basilica answered the purpose of an exchange, and that it was an open portico consisting of supports carrying a roof similar to modern covered-in market places. The great Julian Basilica was presumably of this type; but some privacy was secured there by low screens being built between the piers, and by curtains being hung in the archways, which could be drawn at pleasure. The need of privacy led ultimately to walls being built round the portico. Vitruvius in the description of the basilica he designed at Fanum implies that such walls, "parietes," were built; a wooden roof with coved ceiling, "testudinatum," was thrown across the "media porticus," while the enclosing passage had a lean-to roof.

Plan.—Thus on plan there was a wide central nave, with aisles on either side and an enclosed space at either end. Greek writers speak of the Roman basilica serving further as courts of law. The basilica at Fanum was connected with the temple of Augustus, used also as a hall of justice; therefore it was an easy transition to dispense justice in the basilica itself. The enclosed space at one end served as a porch in which those persons could wait who were interested in the verdict; the space at the opposite end was raised above the general floor level and reserved as a tribune for the magistrates. As the merchants were apt to interrupt judicial proceedings by their clamour, the next step was to build out a semicircular tribune cut off from the rest of the hall by low screens. Thus we have the fully developed basilica, with vestibule or narthex, porticoes or nave and aisles, raised tribune or choir, and hemicycle or sanctuary.

Wall.—No peculiar method was developed systematically in the construction of the basilica. The earliest one, built 184 B.C., and the largest of all, built by Trajan nearly 300 years later, were alike in having lintels resting on the columns of the portico; whereas in the Basilica Julia of intermediate date the columns were replaced by piers and pilasters, between which arches were turned. Again, in the latest basilica, built by Constantine, columns were replaced

by walls of solid concrete, which from their less valuable material have fortunately been allowed to remain partially *in situ*.

Roof.—It is doubtful whether all basilicas were covered buildings. Some, at any rate, were roofed from a very early period, as is proved by an old coin in the British Museum, which shows that the Basilica Æmilia of Lepidus, built 179 B.C., consisted of an open peristyle carrying a sloping roof. Trajan's enormous basilica, with a central nave 87 feet wide, is said to have been spanned by gigantic roof timbers brought from Lebanon, and some authorities hint that these timbers were removed to roof the Christian basilica of St. Paul's-without-the-Walls. The nave of the Basilica Constantine in the Forum was practically of the same height and width as that of Trajan's basilica, but the use of magnificent intersecting vaults in three compartments did away with the necessity of numerous points of support, and a considerable amount of space was thereby gained on the floor level.

Ornament.—In the columnar basilicas the chief decoration was derived from their constructional features. The columns of the peristyle, which were of precious marbles or of polished granite, produced, especially when the aisles were double, a very rich effect. Marble columns attached to concrete piers, bronze screens, stucco modelled, gilt and painted, gilt bronze tiles and statues, all contributed to the fame of these magnificent Roman structures, the last of which—the Basilica Constantine—is peculiarly characteristic of an architecture that results from the structural requirements of the people and from the nature of the available material.

Byzantine.

Roman art received a check and advanced no further, just when it was about to throw off the pretence of copying Greek forms, and so to complete its development.

In the fourth century artistic effort was suppressed by the influx of barbarians into Western Europe and by the removal of the seat of the Empire to Byzantium, a city founded by the Greek colonists a thousand years before. During this period Greek builders had perfected a style of building based on a rational marble construction. When the coming of Constantine brought new requirements, this keen, sympathetic race quickly assimilated new ideas, and by the discretional use of local material and the consideration of fresh conditions they opened up a new method of constructive art.

In all great styles it is in the ecclesiastical buildings that we trace the first germs of a new development. The fourth-century pagan buildings of Rome were characterised by a lavish use of degraded ornament. The Christian churches, in order to establish a contrast, suppressed architectural forms and built on strictly utilitarian lines.

When this principle was carried to the East by the Romans, the Greek builders interpreted it in their own way, and instinctively revived the art of decoration. Not indeed by recalling obsolete features, but by modifying their own ornament to suit new conditions. In a hundred years the development was completed. Morris says of its greatest example, St. Sophia: "The style leaps into sudden completeness in this most lovely building." This perfection was so rapidly attained because of the essential characteristics of the work, which are directness and economy of labour, both in construction and in decoration.

Choisy defines Byzantine art as the result of the Greek spirit working on Asiatic elements. Byzantium was in constant commercial touch with Persia, so that side by side with Greek influence we find traces of a Persian origin.

Roof.—The most important feature in a Byzantine building is the domical roof of Persia. In Rome the domical form had been used, but it was a cast dome, exerting no lateral pressure, and it had never been directly applied to a square plan. In New Rome the problem was

worked out of surmounting the Christian basilica with a constructed dome, which required neither the mass of material nor the amount of labour put into the ancient concrete construction. In the construction of the brick dome lay the keynote of Byzantine architecture. The builders aimed at a system that would suppress all preparatory work; that would enable them to build without centres, and so to construct their domes in sections, after the Eastern manner. The problem was solved by the introduction of the dome on pendentives, which is light in material, though it exercises a slight outward pressure. This thrust is met by smaller domes, and in this system of equipoise we find the germs of the Gothic principle of meeting thrust with counter-thrust.

Plan.—Mediæval Greek differed from Classic Greek architecture in that as the style developed the roof and not the wall became the important feature. The plan was entirely ruled by the dome. Throughout the buildings of the fifth century we can trace in a series of churches, arranged chronologically by Mr. Lethaby, how the dome piers grew in importance, supplanting the nave columns of the basilica without, however, placing the circle of the dome in a distinct relation to the three aisles. In the sixth-century church of St. Sergius at Bozra the dome stands over a central octagon contained in an external square, and in the perfected plan of St. Sophia the union is complete.

The plan of this building is merely the fulfilment of conditions imposed by the dome. This is buttressed by surrounding vaults, so that the thrust is distributed over the whole area of the building. Paul the Silentiary thus describes this pyramid of domes: "Thus rises on high the deep-bosomed vault, borne above triple voids below . . . and, above all, rises into the immeasurable air the great helmet, which, bending over like the radiant heavens, embraces the church."

Wall.—The leading idea in Byzantine construction, says Choisy, is the independence of masonry unequally charged. Consequently we find external walls composed, as in late Gothic times, of piers and screens; only in Byzantine work these meet with a straight joint. The straight joint was expedient for a twofold reason. First, a building constructed of independent walls would suffer less from earthquakes, against which provision had to be made in the East. Secondly, since stone was used in those portions of the building subjected to great compression, and brick in other positions, settlement would not take place equally, and bonding between the materials of different sizes would have resulted in cracks and failures.

Another fundamental principle of the Byzantine style is the true use of the round arch and the frank use of brick, whereas the Roman had been at pains to mask his arches and to hide his construction. Though the whole of the internal brickwork of St. Sophia is overlaid with marble, there is no attempt made to simulate a marble construction. When the brick body had been completed and allowed to settle, the marble dress was applied. Marble frames and screens were inserted in the window openings; the marble jambs and lintels of doorways mitred where they met and proclaimed their non-constructional functions; the walls were lined with great slabs of inlaid marble, placed on end and frankly used as a veneer. Marble pavements and mosaic vaults completed the decoration, which, says Mr. Lethaby, with all "this utmost splendour is quiet and soft in its result."

Ornament.—The structural necessities of the dome settled the plan of the building, but the flat treatment, characteristic of Byzantine work, is the result of the decorative scheme, which excluded unnecessary architectural features, but made extensive use of marbles and mosaic. The column and the arch were necessary features, but by the suppression of the fragment of entablature, so characteristic of Roman work and so irrational a survival, the Byzantine builder succeeded in bringing these two features into a happy union. The

arch thus bore firmly on the abacus, and the connection was completed by the invention of a capital which from the square of the abacus gradually approached the circular form of the shaft.

The ornament enriching the capital, as indeed all Byzantine carving, was incised only, so that the original shape of the block is not lost. This insistence on the nature of the stone is the most characteristic feature of Byzantine carving. It is an additional proof of the rational development of a style which, from the universal principles on which it is based, was to influence architectural art from the Black Sea to the Atlantic, from the Mediterranean to the Baltic.

Romanesque.

The great development known as the Romanesque style did not appear till the year 1000 A.D., but its root is to be found in Byzantine or Early Christian art. When the Germans, who may lay claim to have invented the style, swept down on Italy in the fourth century, they checked the natural evolution of art in Rome, and impressed on it a new and healthier character. And yet Roman power was so traditional that these northern people thought they could do no better than try to copy Roman monuments. In the sixth century Ravenna, besides being the acknowledged capital of the Western Empire, became the seat of the Byzantine exarchs, and gained in importance both in politics and in art. From this time onward artistic works yielded to Byzantine influences, but only a few examples have survived to show the source of Romanesque inspiration.

In the mausoleums of Galla Placidia and Theodoric and in the churches of St. Apollinare Nuovo and St. Vitale, Ravenna possesses almost the only examples on Italian soil of fifth and sixth century buildings, all Byzantine in character. After this, art stood still, while the struggles of Ostrogoths and Longobards, added to disease and famine, devastated the land, so that but few buildings are preserved between 600 and 1000 A.D. In the eighth century Charlemagne, indeed, wished to restore the Roman Empire and to bring about the Renaissance, which came of itself in the fifteenth century. But Teutonic and Eastern elements were too numerous, and on the opposite principles a style was eventually developed which reached a rare perfection, and was the expression of the Teutonic contribution to Gallo-Roman races.

Little remains in Germany to represent Early Christian art in the north. The chief monument is Charlemagne's minster at Aachen, built 804, which is, without exception, the most important building of its class in Europe. Its plan and decoration were unmistakably suggested by St. Vitale, Ravenna, though some of the forms used betray the clumsy local work of its period. From analogy and historical evidence we seem justified in assuming that almost all churches of this date were circular, but that after the eleventh century the circular form was discarded, as it offered no facility for the accommodation of numbers. Hence this radical change was effected in the plan by yielding to a structural requirement.

In France, where Charlemagne introduced modern arts from the East, there was a continuous development in architecture, which was fostered in the monastic establishments. In Europe at this period there were only two powers, the military and the religious. Since the spiritual always prevails over the lay power, the monasteries became richer and more important than the castles, and were the chief agents in spreading civilisation. Until the eleventh century the monks took the lead in teaching, in the practice of agriculture and handicrafts, in the study of arts and sciences. Within the monastery wall were grouped church, school, infirmary, hostel, and granary, as is all set forth in the plan of St. Gall, dating from 802 A.D. The plan of the church in this instance is of the basilican type, which shows

that Roman as well as Byzantine influence was alive. But even at this early period ritual requirement had introduced a modification into the plan of the basilica by the addition of a second choir.

Although monastic architecture alone is found up to the twelfth century, the religious orders were too busy with their work of reform from the ninth to the eleventh centuries to found vast monasteries. It was only when they had partially succeeded in suppressing barbarism that they could turn their attention to building suitable, well-planned establishments, and that the Romanesque style was developed.

The feudal system reacted on monastic architecture and divided it up into as many units as there were orders. Each order had its own style of building, recognisable at a glance. The Benedictines were usually satisfied with the basilican plan for their churches, though they sometimes added a crown of chapels at the east end. They were lavish in the use of sculpture and ornament, owing to the soft nature of the stone they used. The strict Cistercians, who were founded as a protest against Benedictine luxury, planned abrupt, square-ended choirs. The building depended for its effect on the rugged Burgundian stone, for St. Bernard had prohibited figure and animal sculpture. The Carthusians affected so severe a treatment in their buildings that these can hardly be accounted architecture.

From 1000 A.D. we have types in different lands, showing separate schools. Northern and Central Italy form one school, Germany forms a second, while France has nearly as many schools as provinces. The difference in each case is accounted for by local requirements, local tradition, and local material. The chief development in the style consists in the perfecting of arched construction and in putting materials to a new use.

The Romanesque builder treated his material differently from the Roman. Roman mortar was used only as a cement. In Romanesque times it was used to transmit pressures. As soon as its purpose was altered, the concrete core and brick facing were done away with, and dressed stone came into general use.

Just as the dome dictated the plan of the Byzantine church, so the attempt to dispense with inflammable wooden roofs and to vault only with stone accounts for the variations of plan in Romanesque churches.

Plan.—Two plans had been handed down to mediæval builders, the three or five aisled basilica of Early Christian times and the circular plan. The latter had been early abandoned for reasons already stated. There remained only the basilican plan to be adapted to three separate needs: first, the parish church, which provides for a moderate congregation; second, the monastic church, which provides for a lay as well as for a monastic community; and third, the cathedral church, which provides for the episcopal functions of bishop and chapter.

The basilican plan has this disadvantage, that the nave piers have to be very massive in order to support the nave wall and the vault above. In Germany we generally find these piers much slighter than in France, for the German builder only vaulted where he had a counterpoise, and consequently threw wooden roofs over his naves. In order to lighten his piers still further, and to increase the accommodation, he evolved that peculiarly German building, the Hall Church, in which there are no nave walls; but nave and aisles, being of equal width and height, are roofed by three vaults of equal span. Poitiers Cathedral is an early example of this inartistic interior, which is seen at its best in Vienna in the Gothic church of St. Stephen.

Nave.—The spans were never great, rarely exceeding 30 feet, for the builders feared dislocation owing to the thrust of the arch. Consequently the width of nave and aisles was correspondingly limited.

Transept.—The addition of transepts to the plan seems to have been a Romanesque

device for increasing the floor space, for transepts were not usual in Early Christian times. The crossing of the nave and arms would suggest a central tower, and the staircase to the transept roof would suggest staircase turrets, all these being features arising from the necessary development of the plan.

Choir.—The development of the choir was equally the result of structural requirements. The Early Romanesque choir ended internally and externally in a circular apse. At St. Hilaire, Poitiers, the apse itself is surrounded by semicircular chapels alternating with windows. On plan the chapel walls were soon made polygonal owing to the difficulties arising from working window arches and sills in the round. These chapels in the Gothic period gradually increased in number and clustered round the apse, divided from each other only by the thickness of a buttress. They were peculiarly necessary in cathedrals to enable the large staff of clergy to say Mass without undue delay. A passage was necessary to enable the public to reach these chapels; and this, though rare in Germany, is common in all French Romanesque churches of importance. Thus out of the simple circular apse, different necessities created the Gothic choir, with its processional ambulatory and chevet of chapels.

Vault.—The object the mediæval builder ever had in view was to design a vault which should combine stability with lightness. The numerous forms these vaults assumed are due to the local influences at work. In Germany there was no constructional progress. The earliest nave vault is found in the monastic church of Laach, and dates only from 1112. The characteristic feature in German roofs is rather a multiplication of small circular or octagonal towers, combined with polygonal domes. In England we have the barrel vault taught us by the Norman builders. It is in France that we find the greatest variety, and the steps that led eventually to the solution of the problem. At Le Puy, in Auvergne, we find the eastern dome on squinches. At Fontevrault Abbey, in Aquitaine, four Persian cupolas roof the nave. At St. Front, Périgueux, and in its neighbourhood we find Byzantine domes on pendentives. In the extreme south there are barrel vaults. At St. Philibert, Tournus, the difficulty of thrust is met by turning a barrel vault over each bay of the nave, the vaults of the aisles receiving the thrust of the transverse arch. The effect is ugly but interesting. At Carcassonne three tunnel vaults run the length of the nave and aisles; but neither is this satisfactory owing to the difficulty of lighting the nave. In the north the barrel vault was replaced by the Syrian groined vault with ribs of masonry, and the vault problem was nearly solved. The difficulty of making the keystones of transverse and wall rib of equal height led to the introduction of another Syrian feature: the pointed arch, which carried the vaults, concentrated their weight on isolated points of support and originated the style of construction now called Gothic.

Ornament.—Colour was largely used as a decoration by all the schools of Romanesque architecture, and where local materials offered a variety in colours the builders took advantage of this. For example, in Auvergne black lava, white chalk, and red brick are used as contrasts in actual construction. The want of tools is responsible for the poorness of the sculpture, for only that kind of carving could be executed that required primitive instruments. The ornament in those districts where Roman tradition survived is a corruption of Classical detail. In Germany, Normandy, and Poitou it is Byzantine, and consists of profuse surface decoration, composed of scales, geometrical combinations, and interlacings, copied from the tapis sarrazinois used as vestments and altar-pieces.

GOTHIC.

In construction and detail alike all through Romanesque work we trace the influence of tradition, which acted as a clog and prevented the builders from fully realising their aim. Tradition is useful up to a certain point, but in building it should be used as a stepping-stone, not as a corner-stone. Now experiment is the principle of Gothic architecture, and after the twelfth century we find a home-born art growing up in France. The new principle of experiment superseded existing principles and radically changed the architecture.

The material used by Romanesque and Gothic builders was the same, viz. stone. Therefore it is to the structural requirements of the age that we must look for any development. How rapid this development was is illustrated by the wonderful series of cathedrals erected in Western Europe during the thirteenth, fourteenth, and fifteenth centuries. In these buildings we see how reason ruled matter, and how the same force which brought their art to its perfection also wrought its downfall; for at the end of the fifteenth century Gothic architecture by striving after external formalism overreached itself. The nature of the stone was set at nought. Feats were required of it which were unnatural; extreme skill in handling material defied common sense and caused the decline of the style.

As France was the cradle of Gothic art, it will be most suitable to trace the progress of the style in its own home. Gothic architecture was not a development of Romanesque. The lay school of the twelfth century broke with ancient tradition and introduced a style founded on rational methods of construction. The Gothic builder aimed from the first at obtaining equilibrium in his building by opposing active forces to active resistance. The resulting appearance or style depended entirely on structural necessities. When an ornamental feature was desired it was not constructed purely for ornament, as the Romans constructed their decoration. Thus the belfry grew into the magnificent bell-tower best illustrated in the English Gothic of Lincoln and Canterbury Cathedrals; the tower roof grew into the spire so common in Germany, where the famous open-work spires of Strassbourg and Freibourg show such a want of consent between material and design; the extra weight required on the buttress grew into the ornamental pinnacle most boldly treated in France, and more especially in the choir of Beauvais the window mullions were curved into tracery, of which some of the richest flamboyant examples are to be found in the fifteenth-century St. Maclou, Rouen.

The aim of the Romanesque and Gothic builders was the same, *i.e.* the perfecting of the vault system, but the methods they employed were different. The most radical change in the construction lies in the use of the ribbed vault, and this permanent scaffolding, as one might term the ribs, was one of the greatest discoveries ever made in construction, and is certainly the keynote of Gothic work. The history of Gothic construction is contained in that of the rib and its attendant the flying buttress.

A vault rib was no new thing, for the Romans had used it centuries before, only in their artificial manner they had concealed it in the mass of inert filling. It was by giving prominence to the rib, and by making use of an active instead of an inert shell, that the Gothic mason created a style.

In ancient buildings we feel that the material gives out only a fraction of the effort of which it is capable. Now in Gothic cathedrals we feel that matter works to the limit of its resistance. We have even documentary evidence that architects calculated the strain their material was capable of bearing. In the transactions relating to the building of Milan Cathedral a dispute is recorded relating to the thickness of buttresses. A Frenchman had criticised them as being too slight; the Italian masters argued they were sufficiently thick, for

the marble and Sarizzo stone used on the cathedral could bear twice the weight borne by Paris limestone. The mediæval builder appreciated the nature of his material, and out of its true use has been developed the greatest of all architectural styles.

Only a change of method can revolutionise art and science, and this change first took place in vaulting. The disadvantage of the Romanesque groined vault with keystones of different levels was so apparent and irremediable that the ribbed vault was adopted, and the alterations in construction that the rib entailed form the basis of what is now called the Gothic style.

The first effect of ribs carrying the whole weight of the vault was to concentrate the load on the nave piers, which resented the stress and buckled. To remedy this evil the flying buttress was designed. At St. Denis *circa* 1140 we see the first attempt to produce, by use of buttresses, a system of equilibrium. M. Gonse shows ably how Abbot Suger's first systematic application of this new principle was the last of a series of experiments covering a period of fifty years, thus demonstrating that the aims of Romanesque and Gothic builders were identical.

Plan.—In this early example of a buttress resisting the thrust of a ribbed vault arch we notice that the system of vaulting to be adopted gives the plan of the apse. So surely was the construction of the vault the starting-point of a design that in later French buildings when the system was fully developed, from the plans of a church, the main features of the structure down to the number of mouldings and the section of the vault ribs can be reproduced. In Amiens Cathedral, begun 1220, we see for the first time the principle of the Gothic style successfully carried into the smallest detail. On the construction of the vault depend the walling, the form and dimensions of piers, their spacing, the width and height of the windows, the position and strength of the buttresses, the size of the pinnacles, the number of the flying buttresses, the roofing.

Let us take each feature in turn and see how the structural requirement of the vault modified and developed the style.

Wall.—Practically speaking, there are no walls. With the earliest Gothic builders the arch dictates the vertical point of support, and from it alone is the architecture derived. The Romans used the arch largely, it is true, but their points of support were inert masses; the voids were practically dug out of the block. In Gothic work each point of support is stable only as long as it is propped and loaded. Every thrust of an arch is counteracted by another arch. Walls disappear. They are used to block up, not to carry; a contrast to the walling in the great temple at Agrigentum, where the intercolumnar walls carry the lintels.

The choir of Prague Cathedral is an example of one of the triumphs of construction achieved in the fourteenth century. The upper part is a glasshouse, and has literally no walls, the masonry being reduced to the vaulting shafts. Again, in the clerestory of the choir of Amiens Cathedral the solid area is one fortieth of the void space. Even modern warehouses are modest in their attempts to remove wall masses and to substitute glass, when compared with these examples of Gothic construction.

The system is one of airy lightness coupled with imposing boldness, and consists of a skeleton which stands not by reason of its mass, but by a combination of oblique forces which neutralise each other. It was only thus that a minimum of material could be employed, and it was in the thirteenth century when this requirement of a maximum of space and a minimum of material was successfully dealt with that pure Gothic was developed. Mr. Jackson expresses it thus: "Romance and sentimentality had no part in the creation of Gothic architecture; it was moulded to the forms under which we find it, by carefully satisfying social

and individual requirements and diligently observing the stern necessities of convenience and economy."

Pier.—The Romanesque pier was wasteful of both material and space. It had to resist the thrust of the vault, and was made correspondingly sturdy. Now economy of material was a great consideration with mediæval builders, who had to contend with difficulties of transport and local regulations hard to realise nowadays. A reduction in the quantity of stone implied a corresponding reduction in trouble, anxiety, and expense. Again, in Romanesque monastic churches the seating area was not a serious matter, but in cathedrals it was of the greatest importance to minimise the obstacles to sight and sound. Early cathedrals were not only places of worship, they were public buildings used for civil purposes, a sort of sacred forum, and intended to accommodate large numbers. Added to this in the thirteenth century the preaching orders of Franciscans and Dominicans arose, and a demand was created for spacious halls. In Italy, in the churches founded by the preaching orders, there is no division into nave and aisles. The church consists of nothing but a large hall for the congregation, with a chancel for the choir and a wooden ceiling thrown from wall to wall. In France we find another practical and sightly plan in the great two-naved cathedral of Toulouse, where the 60-feet-wide naves are spanned by noble vaults.

In the basilican plan the simplest way of increasing the floor space without increasing the actual size of the building would be to diminish the area of the solid supports or, in other words, to reduce the pier. At first every vaulting arch, wall, transverse and diagonal, sprang from the abacus. Experiment showed the advantage of keeping the keystones at one height and of giving the varying spans more or less the same acuteness of arch. This could only be attained by making the ribs spring at different levels, so that they interpenetrated. Interpenetration meant a lesser section at the lowest springing, which meant a smaller bearing surface, which meant a reduced pier. A further modification due to the difference of levels in the springing of the ribs was the suppression of the abacus. When the smallest section of the arch bed corresponded in size with the pier itself a larger bearing surface was needless. The abacus became superfluous, and in the fifteenth century the ribs of the vault are continued to the ground level in the form of piers, whose spacing in France, though not invariably in England, corresponds to the limits of each bay of the vault.

Windows.—One of the most important results of concentrating the weight of the vault on piers was the possibility of opening broad high windows. These totally altered the character of the interior by admitting a flood of light which produced effects hitherto undreamt of. The natural limits for the window opening would be the external pier and the wall rib of the vault. Indeed in the thirteenth century this rib often penetrated to the exterior of the wall and formed the relieving arch of the window. There is one peculiar exception to the vault limiting the height of the window, and that is in the early Burgundian churches. Here the wall rib is isolated from the wall and carries the vault only, while on the exterior the window can be carried up to any height.

Buttress, Pinnacle, and Flying Buttress.—As these are external structural requirements, existing simply on account of the thrust exercised by the vault, their arrangement, size, and number will depend wholly on the position, strain, and height of the internal vault.

Roof.—The Romanesque outer roof was of low pitch, rarely exceeding forty-five degrees. The Gothic roof, on the other hand, was made a prominent feature, and it rose sheer and steep, forming a mountain of slate in Ulm and Rheims Cathedrals. The more domical the internal vault, the higher must the external wall be raised above the wall rib in order to carry the wooden roof. This entails a waste of material and money. The thirteenth-century

builders saw this and made great efforts to reduce all keystones to the same level. This resulted in the surface of the shell becoming at times so undulating that it threatened to fall in. To avert this, intermediary ribs were added, which stopped short at the lierne joining the key of the diagonal to the key of the transverse arch. The development of French vaulting stopped at the introduction of these necessary ribs. It remained for the English builders to multiply the ribs till they became decorative and not structural, the final development being the fan-tracery vault whose shell carries the ribs, and is convex instead of concave in form. In Henry VII.'s Chapel, Westminster, the form is so much at variance with reason that pendants replace the pier in the work of supporting the ribs.

Thus we see how a change of method in vaulting brought about a complete change of appearance in building, and how new methods of application developed new forms which were afterwards classified as a style.

Ornament.—One of the happiest inventions of the Gothic builder, and one of the chiefest glories of his cathedrals as exemplified at Chartres, is to be found in stained glass. This followed almost as a necessity on the design of such large windows as were required to light vast buildings in the north. It was a natural wish to beautify features of such dimensions as these windows, and the obvious decoration would be glass of various colours, through which the light would enter as through a collection of jewels.

Colour decoration on the walls was not so largely used as in the previous styles; indeed in late Gothic it was not used at all. For one thing the coloured light transmitted by the stained glass would have neutralised the effect of colour on the walls; and secondly, the complicated and skilful combinations in construction would lose some of their effect were the eye distracted by colour.

This preference of form to colour is emphasised by the profuse use of sculpture, the noblest of all ornament. Gothic architects were alive to its value, and in all their best work statues abound. They add life to the whole, and, though often uncouth and grotesque, enhance the architectural effect. Where more modest decoration, such as carving, served the purpose, the same spirit that led the Gothic builder to trust to his own resources and abandon Roman-Byzantine traditions led him to discard foreign ornament. Henceforth ornament as well as construction is home-born. Strings, mouldings, capitals, keystones, are covered with flowers and leaves taken from local flora. This imitation follows a methodical process. Just as buds and shoots first appear in nature, so these are the first to inspire the sculptor, and are used to emphasise architectural lines. Later on the mature flower is modelled so closely on nature, and applied with so little discrimination, that it forms no part of the structure, and could be removed without injury to the design.

Castles.—In mediæval times the building next in importance to the cathedral was the castle, and in it we can as surely trace the development from necessity and material. Defence and safety were the primary objects in the design of a dwelling, and the chief dwelling in the town—the lord's castle—was built, where possible, on an eminence. Its plan was necessarily irregular, from the nature of its site and from the changes in its defences required by new methods of attack. Up to the thirteenth century the castle depended on passive strength, which was sufficient to resist the clumsy and feeble methods of attack. Stout walls to resist the ram, and tall towers from which to shoot arrows with impunity were the chief essentials. In the thirteenth century, from circular, these towers changed to ogee on plan, so that greater thickness of masonry was presented to the ram. In the next century the temporary wooden balconies from which missiles were hurled on intending escaladers, and which crowned wall and tower alike, were recognised as sources of danger, for they frequently

caught fire from the burning balls launched by the enemy. Necessity demanded some change, and these wooden platforms were built as stone or brick machicolations, and produced some of the finest effects to be found in mediæval castles. To start with, they were purely utilitarian, but they look so imposing and business-like that they were retained on sixteenth-century castles, though worse than useless against artillery.

Another effective feature in these buildings is the battering wall. This, again, was dictated by necessity. If once the enemy could reach the foot of a perpendicular wall he was in comparative safety. But if the wall had a batter he was compelled to halt some distance horizontally from the archer, who could thus bring his aim to bear.

In the fifteenth century artillery was so much improved that the shock of cannon shook the high roofs and slight vaults of the strongholds. These were removed, and gradually tower and wall were lowered, till nowadays defences are level with the ground, and are made as invisible as possible instead of towering up as visible signs of power and dominion. What science has gained, art has lost, and this is apparent not only in matters military.

Renaissance.

With the fifteenth century in Italy and the sixteenth century in Northern Europe modern times may be said to begin. Renaissance architecture is the direct consequence of this birth of modern civilisation. The characteristics, political and social, of the Middle Ages were thrown off, and the history of this upheaval was recorded in architectural monuments.

Whenever there appears a group of buildings upon a great scale, it means that some peculiar and powerful social force is at work. The force at work here was human culture as opposed to ossified scholasticism; the recognition of the individual instead of the community; in a word, the reform of society. Italy enjoyed comparative quiet; France had become a united kingdom; England was at peace with her neighbours. Consequently there was a general settling down of society, and by far the largest group of buildings in these three countries consisted of dwelling houses upon whose decoration the same ingenuity and labour were expended as in mediæval times had been lavished on ecclesiastical buildings.

This style can hardly be said to be much influenced by material. Whether the building be of stone, brick, plaster, or wood, the attempt is always made to preserve the same outward forms, though in the early stages of the art great variety resulted from the sway of individual fancy over tradition. That structural requirements are its basis is illustrated by the different aspects it assumes in Italy, France, and England according to the national life and customs of each country.

Plan.—In Italy there is a total absence of comfort in the plan. The dwelling, palazzo or villa, consists of a series of vast apartments, of a collection of porticoes, halls, and galleries, meant only to please the eye. This was partly the result of the outdoor life led by the Italians, who required, not a home, but only state apartments in which on ceremonial occasions throngs could congregate. Partly it was due to the Italian temperament, which was more artistic than practical, and laid more stress on the decorative appearance than on the purpose of a building.

In France the plan of the chateau is the horizontal version of the mediæval keep. One large guard-room after another has to be traversed before the private apartment of the master, a similar vast chamber, can be reached. It was only towards the middle of the seventeenth century that small rooms were generally included in the plans of a dwelling, and led to some degree of comfort and privacy.

In England the houses were neither palaces nor castles. They were simply country seats, and correspondingly comfortable and homelike in their internal disposition.

Wall.—In Italy stone or brick was used according to the local material. In Florence the great rusticated blocks of the Pitti and Strozzi Palaces recall the huge masonry of ancient Etruscan builders; while in Lombardy, especially in Bologna and Ferrara, the local brick is treated in as grand and decorative a manner. It is interesting to note that the fifteenth century took up Roman architecture at the point at which it had been dropped eleven centuries previously; that is, when it was freeing itself from Greek influence and developing an outward form of its own. The Roman builders were gradually working away from the screen of Greek columns, which they had flattened down into inconspicuous pilasters, and the next step would have been to omit the pilasters altogether. Alberti's Palazzo Rucellai in Florence and Bramante's Cancelleria, the first Renaissance building to be erected in Rome, were faced with very flat pilaster strips, not with Classical columns. But the style, instead of advancing, worked backwards, till its leading principles of symmetry, strict uniformity, and constant repetition tyrannised to such an extent over the design that a whole was produced, often masterly and majestic, but always a sham. The spirit of Renaissance architecture, when matured, is the antithesis of the spirit described by Leighton as actuating the builders of the Middle Ages, "masculine independence, fearless sincerity in expression, scorn of shams, and trust in Truth."

In France and England the design and construction remained Gothic long after so-called ancient decoration had been imparted. Lescot, in his splendid design for the Louvre, 1541, was the first Frenchman to work on Classical principles and to produce a model for the true French Renaissance style.

In England it was only in 1620 that Inigo Jones introduced Palladio's strict rules for Classical building. For fifty years previous to the erection of Whitehall, a design remarkable for its Classical feeling, builders had been content with a Gothic shell plastered over with Roman detail.

There is an important difference in the treatment of openings between Italian and northern builders which shows the latter to have been the better constructors. In Italy a void was left in the stone wall, and the marble frame to the window or door opening was inserted like a wooden frame would be. In France and England the ornamental work was built in along with and tailed into the rest of the wall.

Roof.—In the three countries there is a marked increase in the use of timber for ceiling and roof. Vaulted ceilings are rarely met with, especially in the north; whereas wooden ceilings, elaborately carved and painted, or covered with modelled plaster-work, are some of the most beautiful decorations of Renaissance buildings.

The wooden roofs of Italy are flat or of slight pitch, as is usually found in dry, sunny climates. In France the Gothic wealth of sky-line is perpetuated in the early towering, high-pitched roof, with its forest of chimneys and dormers, and in the later imposing Mansard roof, which add immeasurably to the effectiveness of the great French Renaissance buildings. In England a compromise was effected by the use of a pitch which was sufficient to carry off the abundant rain water and yet did not give undue prominence to that unclassical feature, the roof.

Ornament.—In Italy every art and every handicraft was called in to adorn the building, and their harmonious co-operation produced works of the highest importance and of singular beauty. Owing to the dryness of the climate nearly every method employed internally could be applied externally, including sculpture, painting, mosaic, marble inlay, modelled plaster, enamelled terra-cotta, metal-work, and wood carving.

In France and England the dampness of the atmosphere would not admit of these various methods, so that the external ornament is generally restricted to stone carving. This is of surprising beauty in France, where the builders did their utmost to relieve the coldness and monotony of Classic imitation by the variety and richness of a resolutely modern decoration. Such colour decoration was used as could be obtained from the juxtaposition of constructive materials, brick and stone or wood and plaster. Wood carving was also largely practised.

It is only in its early stages that the Renaissance style shows conspicuous national differences. When it was fully matured, and all Europe had acquired a thorough knowledge of the form though not of the spirit of Classic architecture, these characteristics are less apparent, and independent national feeling vanishes. The chief aim in every design seems to be concealment both of arrangement and material. Antique forms are only an external and carefully selected garment applied from choice and not from internal necessity.

In Italy plaster is widely used to conceal the cheap brick construction of palaces apparently built of stone. Rows of windows, alike in size and importance, give light to rooms of various dimensions and purposes. Balustrades crown the cornice, and effectually conceal the presence of the roof.

In France the wearisome pomp and artificial graces of the hotels inspired by the Roi Soleil are far removed from the freedom and charm of the buildings of the truly sunny sovereign François I. This striving after the monumental and massive reaches the climax under Louis XVI., where luxurious and dainty interiors are masked by exteriors worthy in their gloom of a mausoleum.

In England eighteenth-century work was very correct and very meaningless. The architects were so determined to be Classical at any cost that they consulted neither requirement nor material. They remind us of the orator who "in his great solicitude about the choice of words was indifferent enough to the value of his meaning." Late Renaissance is merely a dress, and uncomfortable at that, forced over a reasonable construction, and springing, at any rate in the north, neither from need, climate, nor material.

It is not in the attractive secular buildings of the Early Renaissance nor in the repellent examples of the later period that we find the most important feature of the style. Though the temple is the least characteristic of Roman buildings, the church is the most important among the buildings of the revived Roman style, and the one in which we find the chief glory and the greatest achievement of Renaissance architects, *i.e.* the dome.

The ancient Roman architects cast their domes in concrete borne on solid walls. The greatest architect of modern Rome boasted he could hang the Pantheon dome in the air, and this he has virtually done in St. Peter's.

In plan the churches do not much differ from those in use before the Classic revival. Since this revival did not affect Roman ritual there was no necessity for altering dispositions. In construction they naturally affect the round arch and solid wall, the outward and visible signs of Roman work. The architects also reverted to the heavy system of pillars and tunnel vaults, and in all cases sought to combine with the building the design of a mighty dome. In their decoration the designs betray the painter or the sculptor according as their artist belonged to the class of painter or sculptor-architects.

In France very little church building took place during the Early Renaissance, but a notable feature is the substitution, when restorations took place in a church, of domes for spire and tower. The magnificent eighteenth-century domes of the Invalides and of the Panthéon rank among the greatest of cotemporary works in Europe.

In England, or rather in London, there was great activity during the seventeenth century

in ecclesiastical building owing to a twofold structural requirement. The Great Fire had destroyed church and dwelling alike, and the Reformation, introducing a new form of worship, necessitated new plans and new treatment. The extraordinary genius of Wren produced our great domed cathedral, which, though smaller in size, is more imposing than St. Peter's itself. Although much of the internal and external effect at St. Paul's is due to subterfuge and deception, Wren has met all practical requirements with such skill, and treated the detail with such intelligence, that the whole building stands a monument to his artistic genius.

The splendid series of stately parochial churches Wren designed prove that he did not bestow his best work only on large buildings. In these churches he avoided the inconvenience of pillared Gothic plans, unsuited to modern ritual and ill-adapted for seeing and hearing. He provided the most varied schemes, all well suited to the special purpose they were intended to fulfil, and the best that could be produced in the circumstances. These circumstances were of a hampering nature. Wren had no precedent on which to plan, for the new religion had to create precedents ; but the solution in St. James's, Piccadilly, for seating 2,000 persons, so that all might see and hear equally well, is truly masterly. He was further hampered by want of money, want of time, and want of room. London was rebuilt after the Fire without any methodical plan, and the irregular sites, squeezed in between secular buildings, demanded the greatest ingenuity in planning, if all the available space was to be utilised and the Classical principle of symmetry not violated. The external treatment of these churches was forced in a measure on Wren. He had to build largely in brick for the sake of economy and of rapidity in construction. For the same reason he left the brick bare and unadorned. Even had he ornamented his construction, the effect would have been destroyed by the crowding of the surrounding houses. Instead of squandering his decoration, he kept it for the towers and spires, features which he may claim to have introduced into Renaissance architecture. These rise clear of the house-tops, so that every detail of the design has its full value, as is illustrated by the most successful of all Renaissance steeples—that of Bow Church.

These restrictions, united with a keen appreciation of the structural requirements and the fitness of things, controlled Wren's genius and brought about the peculiar English development of the art of the Renaissance.

Modern.

Modern architecture is so complex, it has to satisfy so many wants of such varying kinds, that it is difficult to trace its development along a single line.

In France, it is true, an official school of architecture has existed for 200 years. It propagates what one might call the Parisian-Classic style, which, like other Paris fashions, influences Continental and American art. Architects are compelled to work in the style of a strange people and to follow the creations of other times, the result being that their designs are prejudiced and hampered by senseless conditions. But that officialdom has not succeeded in quenching the fire of French art is apparent in a number of recently erected buildings, among which the two Palais des Beaux-Arts stand out as triumphs of modern Classic design.

In England the opposite state of affairs exists, and it may be that the very licence allowed to architecture is the reason why our modern style develops so slowly.

It is hardly an exaggeration to say that in England the development of modern art began only within the last thirty years. Throughout the nineteenth century we have had only a perennial reproduction of long-past forms, an eternal Renaissance of bygone styles in rotation.

Finally they are all produced simultaneously, so that the architecture of all nationalities at all periods of civilisation combines to illustrate the needs of nineteenth-century England.

But during the last few years a change has taken place, especially noticeable in domestic architecture. Not long ago it was considered bad taste to own a house differing from that of one's neighbour; now houses can hardly be designed sufficiently varied to satisfy clients.

Plan.—In plans especially the increasing demand for comfort, luxury, and labour-saving devices taxes the ingenuity of the architect and betrays the tendencies of the age.

Wall.—Elevations are as varied as the plans. Since a State building should bear the impress of national tendencies rather than of individual taste, it is only logical that the house of the individual should bear a personal rather than a national character. And this is exactly what we find. The men who are developing the art, and who are more often called upon to design private than public buildings, stamp their personality on their works. As in the early days of the Renaissance, when architects raised their profession from the vilifying influence of the guilds, so it is at the present day in England. The design betrays the artist. But whereas the architects of the Renaissance worked in one style, having one aim in common, *i.e.* to reproduce Classic work, the aim of the English architect is to embody in his design each his own particular conception of beauty. Since these conceptions are based on many periods of many styles in many lands, the result is that our modern architecture is many-sided. Nevertheless it is distinct and characteristic. Not that construction is more skilful than in days of yore; not that material is differently used or more suitably applied; not that detail is more artistically treated than in Early Renaissance work. The secret of the distinctiveness of modern work lies in the modern personality of the artist, and, paradoxical though it may seem, the more he sacrifices to structural requirements, the more he yields to the nature of material, the more strongly is his individuality stamped on his design. The art is a personal art, and as such it reflects the personality of the artist; or, in Buffon's words, "Le style c'est l'homme."

Plan.—The requirements of public architecture are no less various. We need Government and municipal buildings, offices, educational establishments, charitable institutions, resorts for amusement, railway stations, colossal hotels, and other buildings whose uses were undreamed of two centuries ago. In addition the complicated requirements attached to a single structure task the capability of modern architects to a far greater degree than their predecessors were tasked. The marvel is, not that so many buildings are badly planned, but that so many successful solu tions are forthcoming to apparently impossible problems.

Wall.—The charge of meaninglessness and tastelessness brought against much modern work is due in a great degree to the abuse of facility in construction. Besides the stone, brick, wood, terra-cotta, and concrete of former ages, the modern architect has the invaluable adjunct steel which in all situations of stress and strain overcomes the limitations of the weaker building materials. The unsatisfactory appearance of much of our town architecture is due to the unacknowledged use of steel; to its concealment behind a mask of architectural drapery the which being purely decorative ignores the nature of its material and assumes forms at variance with the structural necessities it purports to fulfil.

It is true the Roman masked his constructional concrete as we mask our steel, but the outward form of the Roman dress was in harmony with constructional requirements. The bearing of the ornamental stone lintel was no greater than a structural lintel could have spanned; the voussoirs of an ornamental stone arch were as deep as a structural arch would have required. The Greeks no doubt condemned concrete as a non-architectural material, just as steel is condemned now by the conservative-minded. But in the same way as we look back

admiringly on the concrete architecture robbed of its Greek dress, so will future generations include steel among their legitimate architectural materials.

This use of steel in the construction of walls, both to span openings and to replace the pier, is the result of a structural requirement. In a town whose population and commerce are steadily increasing, it is of importance that offices and warehouses should be near the centre of business; therefore such buildings, instead of expanding laterally and taking up valuable ground space, are made to expand upwards, and that material has to be used which will combine stability with economy of space.

Roof.—The necessity of providing against fire which led Roman and Gothic builders to vault their buildings has led the modern builder to use steel, protected by fireproof material, for his roofs and ceilings. The advantage of steel over the older method is self-evident. In crowded towns there is no room for deep buttresses and massive walls. The steel girder exerts no thrust like the Gothic arch, and its weight does not require the substantial support the Roman vault required. Added to this even the Roman dared not cast a flat concrete ceiling over a greater span than twenty feet, which is insignificant compared with the span of a flat steel girder. Then, again, only the use of steel has made it possible to admit sufficient light through the roof in such buildings as from their purposes require a strong light from above.

Ornament.—We are only just beginning to learn that since most of us live in towns, it is a duty we owe ourselves to make them as comely as possible. The result of this awakening has been an outburst of decoration on buildings which, though often unsuitable, shows a growing desire for art. As a result of our social condition, the class of buildings from which we must expect the growing prospects of town architecture is the class devoted to commercial and business purposes. It is just this class which is most scathingly criticised as being showy in design, deceptive in construction, and lacking every distinction of good art.

The fact that so much of this architecture is a screen accounts for the injudicious application of the decoration. When features are no longer constructional, their original purpose is neglected, and they assume irrational decorative forms. So long as only structural features were enriched there was a limit fixed to the decoration, but when these features are applied as decoration, there is nothing but good taste to limit their multiplication.

The extensive use of terra-cotta is another cause of excessive ornament. By its nature it is so easily modelled and so cheaply produced that it requires great control on the part of the architect to stay his hand. Superfluous decoration and exuberant ornament are the characteristics and chief attractions of Early French Renaissance. But being wrought in stone by artists, this enrichment has a spontaneity, a joyous variety, which is foreign to the mechanical process employed in turning out terra-cotta enrichments.

Yet in spite of the erection of many vulgar and exaggerated buildings others are being daily constructed which testify to an increasing development of the æsthetic element. Banks are willing to pay for costly though quiet marble façades; offices are decorated by the chisel of leading sculptors; shops sacrifice plate-glass expanses to architectural subdivision of wall surfaces; recent theatres are both dignified and artistic in their decoration. There is altogether a craving after better things, and architects are not backward in responding to the requirements of the public.

In America an architecture is being developed which is startling and characteristic of the nation which sacrifices so much to the almighty dollar. There the life of a town building is ten years at the most. "You British use a thing till it becomes useless. We Americans use a thing only till we get something better." That is what the American says, and he

practises this precept in his building with a fervour that to us looks wasteful if not criminal. For surely durability is an essential characteristic of the art which writes the history of a people in its monuments.

It is not surprising that the practical material steel should have found favour in the eyes of this practical people, and that their steel skeleton structures should belong to the "skyscraper style." In New York, which, from the nature of its site, cannot expand laterally, the necessity of growing vertically has led to the construction of "the sharpest thing any architect ever perpetrated." There we have a block of offices—the highest in the world—towering 382 feet in the air—that is, forty-two feet higher than our Victoria Tower. It contains the stupendous weight of 9,000 tons of steel. Without steel piers a building of this height would have necessitated walls many feet in thickness, so that a large proportion of invaluable floor room would have been sacrificed to the supporting area. By the use of steel, which can be erected at incredible speed—two stories a week is the usual rate of progress in these giant buildings—time, material, space, and cost are saved, and infinite facility afforded for internal arrangements.

The greatest of all architectures was developed by bestowing strict attention on these matters, and a modern style worthy to rank with those of the past will eventually arise by adhering to the same principles while consulting altered conditions; for

> Not in vain the distance beacons. Forward, forward let us range;
> Let the great world spin for ever down the ringing grooves of change.

9, Conduit Street, London, W., *20th May* 1905.

CHRONICLE.

Last Monday's Lectures at the Institute.

The Institute on Monday was favoured with two admirable lectures by Messrs. T. Stirling Lee and W. Reynolds Stephens on Sculpture in its Relation to Architecture. Mr. Stirling Lee's was delivered extempore, and some remarkably telling points bringing out the subtleties practised by the ancient Greek sculptors in their ornamentation of buildings, were illustrated by bits of the frieze of the Parthenon shown by photographs. An interesting discussion was contributed to by Sir John Taylor, K.C.B., Professor Beresford Pite, Mr. Hugh Stannus, and the President, the two first named proposing and seconding respectively the vote of thanks. Owing to delay in the preparation of the MS. publication of the lectures and discussion is postponed to the next number of the Journal, when they will be given with the illustrations. Mr. Alfred Gilbert, R.A., and Professor Lanteri, who had been expected to read Papers on the subject, were unavoidably prevented from attending, and the President made their excuses to the Meeting.

Public Works and Municipal Officials.

Writing to the Secretary on the subject of the Institute Memorial *re* the carrying-out of architectural works by municipal officials [Journal, 10th December 1904], Mr. C. H. Strange [*A.*], of Tunbridge Wells, says :—

"It was not until to-day (3rd May) that an opportunity occurred of presenting the original memorial to our Town Council, and that was done at the monthly meeting this morning. You will be pleased to hear that the Council threw out the scheme of the Borough Surveyor for a new courthouse, and that if the proposal to build goes any further there is some probability that the subject of employing an architect will be reconsidered. I think the action of the Council in rejecting the report of its General Purposes Committee to proceed with the Borough Surveyor's plans was brought about, to some extent, by the opportune presentment of the memorial."

Mr. Strange asks for the publication of the above, thinking it may lead others to follow his example. He had ascertained, it appears, that the Memorial had not been presented but had been pigeon-holed in the Town Clerk's office, and through his exertions a Councillor brought the matter forward and the document was read before the assembled authority.

The Intermediate Examination, Sydney, N.S.W.

At the Intermediate Examination held in Sydney, New South Wales, last November, under the management of the New South Wales Institute, three candidates were examined and the following two passed—viz.

ISAACS : Robert Macintosh [*Probationer* 1904], 50 Gurner Street, Paddington, Sydney.

SHIELS : Nicholas Villar [*Probationer* 1904], Farnham, Allison Street, Sydney.

These gentlemen are now registered as *Students R.I.B.A.*

The A.A. Sketch-book.

The Committee of the Architectural Association desire it to be known that the *A.A. Sketch-book* is entering a new volume and that there are several vacancies in the subscription list which they would be glad to see filled by members of the Institute. The peculiar merits of the Sketch-book are too well known to need mention here. The work forms a precious record of all that is excellent in the architecture remaining to us of the past, and as such is of incalculable value to the architect student and an endless source of delight to the cultured amateur. Turning over the leaves of any of the recent volumes, it is apparent at once that only the choicest subjects are chosen and that only the most skilled rendering of them is acceptable to the editors ; also that only the most approved processes are employed for their reproduction. Unhappily, owing to the heavy expenses of production, the work is run at a loss—and a burden of this kind, in view of its still unliquidated building debt, the Association can ill afford to sustain. It is with the hope of reducing the loss on the Sketch-book that the Committee invite members of the Institute to enrol themselves on the list of subscribers.

A Presentation Medal.

From the Library Committee of the Corporation of the City of London has been received one of the Medals struck by order of the Court of Common Council to commemorate the visit of the King and Queen to the City on 25th October 1902 and the Thanksgiving on the following day for the King's recovery from his illness. The obverse bears representations in relief of their Majesties, and is inscribed on the border, "In honour of

the Visit of their Majesties King Edward VII. and Queen Alexandra to the Corporation of the City of London 25th October 1902." The reverse shows their Majesties seated on a raised daïs, the chairs being surmounted by the Royal Arms and the Arms of the City of London. An address of welcome is offered by the City, which is represented by a female figure, draped, wearing a mural crown. Behind is the figure of Fame proclaiming the event. The front of the Guildhall, surmounted by the Royal Standard, forms the background. At the base are the sceptre and mace, symbolising royalty and the civic power. In the left lower corner are sprigs of myrtle with a scroll entwined bearing the motto "Civium Amor et Fides," expressing the loyalty and devotion of the City of London towards the Throne. The Medal has been added to the collection of medals in the Institute Library.

The Roman Forum.

Mrs. Burton-Brown, in a Paper read before the Society of Arts on the 3rd May, gave an interesting résumé of the results of the excavations in the Roman Forum which have been going on under the direction of Commendatore Boni [*Hon.Corr.M.*] since 1898. All the remains of classic Rome which are most full of significance, and which throw the greatest light upon the Romans, upon the development of their religion, their political institutions, and their life, have been revealed during the seven years of the Commendatore's work. He had striven to reach the remains of kingly and republican Rome, and his success has exceeded all expectation.

The period of the Republic (says Mrs. Burton-Brown) has few remains of importance in the Forum which distinctively belong to it, although it is very clear that the notions of the Romans of that most important time in their history, as to religion and as to political aims, are greatly elucidated by the monuments discovered. Pavements and mighty drains of Cato and his contemporaries can indeed be pointed out *in situ*, and the latest discovery (the Lacus Curtius) is one which must not be forgotten. Ovid remarks that in the spot where the gulf opened and closed upon Marcus Curtius, a pavement had in his time been laid down. This pavement, together with two others beneath it, has come to light in the centre of the Forum, and upon it is part of the altar where sacrifice was performed to the manes of Curtius.

Julius Cæsar determined to put an end to the Republic, and to establish an autocracy based upon a wide democratic popularity. As he planned to transform the State, so he transformed the Forum. The buildings in it, whether consecrated to religious or to political uses, had been orientated according to the sun's course when they were inaugurated by the augurs. Walls and pavements can be seen in every part of the Forum lying below those of the Empire, and set up on these lines. One by one each was rebuilt or changed by Julius Cæsar and by Augustus, and in defiance of the old customs of inauguration the new imperial Forum grew up, a broad open square following the natural conformation of the valley and the Capitol. This Forum was dominated by the new rostra of Cæsar, from which the orators addressed the mob assembled in the open space, and no longer the free men of the Comitium. It was lined on both sides by the Basilicæ Julia and Æmilia, and at the further end, appropriately enough, stood the Temple of Divus Julius, just behind the altar which Augustus erected on the site of the pyre of the great dictator. The people as they assembled in the Forum saw it surrounded by monuments of imperial magnificence, and the lofty Temple of Julius, together with the triumphal arch of Augustus, shut the primitive shrines of Vesta, Juturna, and the Regia out of sight and out of mind. In order to enhance its popularity Julius determined to hold the games on a scale of greater splendour than before. It was difficult to find room for this, and it is now found that he tunnelled its length and breadth by a system of five subterranean corridors. By means of these theatrical properties, fighters and wild beasts were brought beneath the arena, and were hauled up to it by small lifts. There are ample traces of the windlasses by which these were worked. The corridors when found were quite choked with earth and rubbish, and now that they have been cleared they are the most salient proof which could be found of Cæsar's political aims.

Statius tells us that a colossal bronze equestrian statue of Domitian was set up under the emperor in the midst of the Forum. Its concrete base was discovered recently. On searching it Boni found a block of travertine embedded in the concrete. A small hole in the middle of it contained six vases of a very primitive type, a type, indeed, which was in use, as we have every reason to believe, about the eighth century B.C. Their contents comprised some gold ore. We know that Vespasian in laying the foundation-stone of the Temple of Jupiter placed in it unsmelted precious metals, and there can be little doubt that we have here the remains of the inaugural votive offering of Domitian's monument.

Outside the Forum a most beautiful monument of Augustus has recently been partially explored by Signor Pasqui, the "Ara Pacis Augustæ." It was dedicated in the year 9 B.C. by the Senate, in commemoration of the victories of Augustus, and of the opening of that golden age of peace which it was hoped that they might bring to the Roman world. It consisted of an altar of sacrifice raised on a platform, and surrounded by a marble enclosure wall covered with carvings in relief, both on the inner and outer side. A large number of slabs from this wall have long been at the Villa Medici, others in the Vatican, the Uffizi and the Terme Museum. Only recently, however, has it been recognised that they were connected, and that they belonged to the Ara Pacis.

The outer face of the screen had a frieze which represented a procession of majestic and dignified Romans, led by the Emperor Augustus to do sacrifice at a shrine. They comprise four Flamines and other priests, as well as the ladies of the imperial family, and portrait figures of Tiberius, Drusus and others. The sacrifice is offered by a symbolical figure representing the "Senatus Romanus," at a rustic stone altar. The shrine is shown as that of a graceful reclining woman surrounded by the emblems of fertility. She has been usually explained as "Tellus," but may equally well represent Augustan Peace, surrounded by the accompaniments of Fruitful Earth. The frieze may be regarded as the marble counterpart of the Carmen Seculare, which is filled with rejoicing over the prosperity which was expected as the result of Augustus's rule. This processional frieze challenges comparison with that of the Parthenon, and in the contrast between them lies the difference between the ideals of Greek and Roman. Upon the Parthenon all dignity and majesty is concentrated in the figures of the "deathless gods," the people are full of light-hearted gaiety, and not one of them is individually characterised. The true religion of the Romans was their loyalty to the State and its officials; hence upon the Roman frieze the dignity and clearly marked personality of the latter is the first quality which strikes the spectator, and

the figure of the worshipped is marked by a merely symbolic grace.

The architectural results of the Excavations in the Forum as far as they had gone up to November 1900 were dealt with in a Paper read before the Institute by Professor Lanciani, *Hon.Corr.M.* [JOURNAL, 12 Nov. 1900].

PORTLAND CEMENT FOR REINFORCED CONCRETE.

Communicated by Mr. BENJAMIN HANNEN, Junr., for MESSRS. CUBITT & CO.

SOME years ago, when carrying out some important experiments on building materials, including cement and concrete, for a firm of architects, we were led to take up the consideration of the qualities of Portland cement in a more detailed manner than is usual amongst contractors, and when reinforced concrete was first brought to our notice it was easy to see that the cement being the most important constituent of the concrete, work could not be properly executed with a cement of inferior quality, and therefore special care would have to be exercised in obtaining a sufficiently good cement. But here a considerable difficulty presented itself. We could see that the ordinary cement then in general use would not be suitable for reinforced concrete; so we decided to draw up a specification based on our own experience, combined with the knowledge we obtained of what was being done in those places where the manufacture of Portland cement had been raised from the common rule-of-thumb methods to a thorough system in which the resources of science had been drawn upon as far as possible.

It was with considerable regret that we found that we had to rely chiefly on French and German sources for the latest information concerning Portland cement—an English invention!

When we first issued our specification we could only find one firm that could completely comply with it; but that cement being produced in only one district, the price rendered it prohibitive, except under very special conditions, when the work was anywhere except in the immediate neighbourhood where the cement was produced. However, we found that some other cement firms were determined to produce a cement of the quality we required, and their efforts have achieved considerable success, for in every work that we have undertaken in reinforced concrete we have not only avoided any failure, but the results have far exceeded our expectations.

There still remains the fact that at the present time the ordinary cement of commerce is not of the quality required for reinforced concrete. It must, however, be remembered that the last word has not yet been said about Portland cement, and that an immense amount of work still requires to be done before the reasons why the material behaves as it does are thoroughly understood. A great deal, however, is being done, and in the meantime we have drawn up a few notes that we now beg to submit for your consideration. They comprise the principal points concerning the methods we use for obtaining a good cement and the methods of using such a cement to the best advantage.

Before giving an order for cement we require answers to the following questions concerning the works of the firm with which we are in negotiation:—

After visiting the establishment, does it give the impression of being properly equipped for the production of good Portland cement?

Are clayey and chalky materials easily obtainable?

Is there a well-fitted laboratory and a staff of experts?

Are samples of the mixture taken at frequent intervals and analysed in order to ascertain whether the substances are present in the right proportions?

Are there appliances and conveniences for putting right any errors found in the preliminary analyses?

Are there rules in force for the vigorous rejection of every particle of unburnt clinker?

If an affirmative answer can be given to each of these questions, then it would be necessary to find out as much as possible of the character of the firm working the business, for it is of no use disguising the fact that the temptation to neglect certain precautions that cost a great deal of money at every stage of the manufacture of cement is very great, and not until we were quite satisfied on the above-mentioned points should we think of giving a large order. If the results of the inquiry were satisfactory we would sooner trust the cement coming from such a firm, without any tests whatever, than accept a new cement which had been tested only as neat cement for seven days.

When the cement that we have ordered reaches the job, a sample is taken and forwarded here and tested in our own laboratory. We first of all ascertain the apparent density in this way: we find the weight of a litre of cement obtained by filling a standard litre measure with the cement by means of a standard apparatus. The weight of the litre of cement gives us a number that tells us the relative weight of cement under the given conditions to water; consequently, if we multiply the number indicating the weight of a cubic foot of water, 62·4 lb., by the number indicating the apparent density, we get the weight of a cubic foot of the cement.

Our cement has to be delivered to the job in bags containing a certain specified weight of the cement; the bags are carefully weighed on delivery,

and any errors that may be found are corrected. The cement contained in one bag is used as the unit in mixing the concrete. Knowing the weight of a cubic foot, and also the proportion in volume of the cement to the aggregate, it is easy to make a gauge box containing the exact cubical contents for apportioning the aggregate to the cement by weight. By this means every gauge is practically of exactly the same proportion—a result that is impossible if the cement is mixed by measure.

Specifying the weight of a bushel of cement should be entirely given up; the variations in weighing so large a quantity as a bushel as ordinarily carried out are too great. It is essential that the determination of the apparent density should always be made on the same volume. Bauschinger, the well-known German engineer, carried out a very large number of experiments, and found that the difference between the weight of the same cement in a litre measure and in a 50-litre measure varies as much as 13 per cent.

We use the expression "apparent density" for want of a better one; it would be a good thing if this or some other expression could be agreed upon in this country to indicate this quality. It should always mean *the weight of a litre of cement obtained by means of a standard apparatus.*

The French and the Germans use for this purpose an appliance made on exactly the same principle, but differing slightly in size. We happen to have a German one, and two important firms—Messrs. Earle of Hull and the Associated Portland Cement Manufacturers, London—are now using the same appliance so as to work on the same lines with us.

We attach very great importance to the apportionment of cement for concrete by weight instead of by measure. It is of importance to note that the better the cement the lighter is its apparent density, the specific gravity being at least 3·0.

Having found the apparent density we next ascertain the fineness. We find it stated in *Testing of Materials*, by Professor Unwin, on the authority of Bauschinger, "that the amount of surface the particles of cement expose increases inversely as the diameter of the particles: a cubic inch of cement would have 150 square inches of surface if the particles were spherical and $\frac{1}{25}$th of an inch in diameter, and 600 square inches if they were only $\frac{1}{100}$th of an inch in diameter; so that the area on which chemical action occurs increases as the cement is ground more finely.

"The finely ground cement will bear a considerable addition of sand with less loss of strength than the coarsely ground cement."

Our experience confirms what is stated above.

We find that the residue even on a 180-sieve is of no more value than sand for strength; but, as Bauschinger states, if these same particles are reground, they are converted into a valuable cement.

In consequence of insisting on fineness of grinding we are now obtaining cement that would have been impossible a short time ago. We are using cement that passes through a 50 and a 76 sieve, and leaves a residue of not more than 9 per cent. on a 180. From one lot that we have used the residue was only 5·15 per cent. on the latter sieve; but this is quite exceptional, and at present it would be unreasonable to insist on such a standard being always reached.

The fineness should control the apportionment of cement by weight; if this is done the special quality of the cement will have to be considered, for it will not be necessary to use so much in weight of the best quality cement as of that of an inferior quality.

Take, for example, two good cements that we have lately experimented upon:—

	Apparent density	Residue on Sieves		
		50 × 50 2,500 meshes per square inch	76 × 76 5,776 meshes per square inch	180 × 180 32,400 meshes per square inch
A.	·915	none	none	5·15 per cent.
B.	1·282	none	7 per cent.	34 per cent.

If the cement be apportioned by weight, then 915 tons of A. will be equal in cementitious value to 1,282 tons of B., thus giving a difference of 40 per cent. in favour of A.

According to Bauschinger, the saving would be a little more, viz. 44 per cent., as 94·85 per cent. of A. passed through the 180-sieve, against 66 per cent. in the case of B. These two cements were free from any uncombined lime, and each had a specific gravity of more than 3·0.

We think it will be agreed that by the apportionment of cement by weight a much more uniform quality of concrete will be obtained, and, further, if such apportionment be based on the apparent density a direct incentive will be given to contractors to use only the best cement, and their demands would have to be met by the cement manufacturers, who would then be relieved from the incubus that now weighs upon them of having to make different qualities of cement to so many specifications.

We next test the setting. Generally in specifications the time is mentioned, but no reference to temperature is made. To show the influence of temperature on setting, the same cement that set in two hours in a temperature of 75° F. took nineteen hours in a temperature of 34° F. and proportionately between.

The question of the setting of cement is a very difficult one, and we think a great deal more has to be found out about it before the matter can be put on a thoroughly satisfactory basis. For all our work we require a slow setting cement, and this is a most difficult thing to get.

We insist on a time limit at a certain temperature for setting in water. Although we find this

method strongly objected to by manufacturers, we have not yet been furnished with any evidence that we consider would justify us in giving it up. It certainly is an essential quality of Portland cement that it should set under water, and its failure to do so would be proof in itself that the cement is not Portland.

The mention in reports of the time of setting without giving the temperature during the time of setting renders the reports on this point of no value whatever.

Tensile Strength.—We venture to express the opinion that figures representing the tensile strength of neat cement at different periods are of very little value.

A cement that we are using had, according to the contract, to be tested by an independent expert; the cement was also tested by the manufacturer and by ourselves. The following figures represent the results at seven days:—

1. Tensile strength of briquettes made by the manufacturer at his works . . .	980 lb.
2. Ditto, made by ourselves	650 ,,
3. Ditto, ditto, but the briquettes prepared by us in a different way from No. 2 . .	1,006 ,,
4. Ditto briquettes made by expert . . .	414 ,,

We could undertake with this cement to make a difference of 400 to 500 lb. tensile strength per square inch at seven days simply by a difference in the preparation of the briquettes.

We consider tests made with cement and sand are much more trustworthy than those made with neat cement, and in our own specification only these tests are described. But all such tests are valueless unless everything in connection with making them is known, and the personal equation of the experimenter known as well.

Moreover, tensile tests of briquettes made with cement and standard sand are only of relative value; they really tell nothing about the actual work that is being carried out; and, further, in all concrete constructions it is the power of the concrete to resist compression that is of chief importance.

Correct information concerning resistance of concrete to compression would be much more useful.

We are therefore making blocks of concrete of a standard size and in the same proportions of the actual materials that we are using on a given building; then after a suitable interval we crush the blocks.

We are also making tests for the purpose of ascertaining the effect of different kinds of aggregate, but always used in the same proportions.

At the present time it is generally supposed that particularly clean gravel and sand are absolutely necessary to make good concrete, great expense having often to be incurred in washing the materials, and in certain districts of getting them from a long distance, because the local gravel and sand are not thought good enough. We are of opinion that when experiments have been made on a sufficiently large scale, it will be found that the present ideas on the subject may have to be modified, and that there is in this country hardly any district which does not furnish excellent materials for mixing with the cement, so long as the latter is of the best quality and the aggregate does not contain any organic matter.

Since writing the above we have received information of experiments carried out by others, all of which support the conclusions that we had come to on the subject. For example, tests extending over a period of three years have been made in America on a sand in which the particles of silicious materials were held together by clay. This sand when taken from the quarry was plastic, and readily caked in the hand like putty, and a coating of fine material clung to the hand while handling it. To one accustomed to the usual specifications for a clean sand, free from foreign substances, the sand in question would be very far from satisfactory.

To the surprise of the tester, the results were superior in every respect to the tests made with standard sand. The seven-day and twenty-eight-day tests of the clayey sand were respectively 40 and 30 per cent. higher.

The difference became less with age, although the three-year test was 20 per cent. above the standard. This, surely, is contrary to the general impression of a good sand, especially at the time these tests were started.

Still another test, which proved the superiority of the presence of clay in a different way. The sand was a pit sand, one sample of which was washed and another was not. The unwashed was 25 per cent. superior, although it contained 6 per cent. of clay.

There are other reports of tests published to show that washing on general grounds is not desirable unless the conditions are unusual.

Specific Gravity.—We use Le Chatelier's apparatus, and insist that the specific gravity shall not be less than 3·0.

Boiling Test.—There seems to be great difference of opinion about this, but we are inclined to regard it as of great importance, and a good way of testing a cement. Certainly each cement that has given us very satisfactory results in actual work has passed the boiling test, and has shown only a trifling expansion when using Le Chatelier's apparatus. But this test for measuring expansion is not very satisfactory, and in case of dispute there would be room for endless discussion. We think this point requires further consideration, and that the latest researches of Le Chatelier should be consulted; it is then probable that some method of testing expansion different from the present one might be adopted to advantage.

A properly manufactured Portland cement is fit

for use when it is delivered; but, as an example of present practice, we find in a specification of cement quite recently issued for an important engineering work by one of the most eminent civil engineers in Great Britain that the cement is to be emptied from the bags on to a floor to a depth not exceeding 2 feet 6 inches, and there to remain for *six weeks before being used*, and to be turned over at least four times in the interval.

A variation of the foregoing clause is to be found in nearly every specification for cement, and would appear to be a direct encouragement to the cement manufacturer to save trouble and expense in taking the steps necessary to avoid free lime in the manufactured article; indeed, one might say, Why should he do so?—if the seller knows with certainty that his customer is going to take great trouble and expense to put right the inferior article that he is purchasing. The spreading-out of the cement, as generally specified, improves a bad cement, but injures a good one.

Although so little is known scientifically about Portland cement, there is sufficient known empirically to enable the conscientious manufacturer to produce a thoroughly trustworthy cement; but there appears to be one difficulty not yet completely overcome, and that is the time of setting.

Any information on the point, based on actual experiments, will be gratefully accepted by us.

It is especially to be noted that at the present moment there is no known chemical method of finding out the quantity of uncombined lime in the manufactured cement. We therefore regard the presence in a specification of a scheme for chemical analysis as of very little use to the user of the cement. There is not sufficient known on the subject to make this test trustworthy.

A FAMOUS EARLY GREEK STATUE.

Reference having been made in the lectures delivered by Mr. Stirling Lee and Mr. Reynolds Stephens at the meeting on Monday last to Greek sculpture not immediately allied to architecture, I should like to draw attention to a notable restoration of one of the most unique instances of the perfect period of early Greek sculpture which, I believe, was first brought to light by a party of four English architects who were making the grand tour nearly ninety years ago.

I allude to the lion of Chæronea, which was set up in commemoration of the Athenian defeat by Philip, King of Macedon, on 7th August, B.C. 338, three years before the destruction of Thebæ by Alexander.

It had been hidden under a mound of earth and its position unknown to earlier travellers, who believed in its existence, from descriptions given by ancient writers, as part of the memorial of the battle. It was also the tomb of three hundred of the valiant Thebans who fell fighting on the side of the Athenians in that engagement, the first battle of Chæronea.

Messrs. Saunders, Purser, Cresy, and Taylor, in 1818, in examining some ruins at Kaparina, in Bœotia, about fifty-two miles N.W. from Athens, observed a piece of sculptured marble just projecting from the earth, and on causing it to be removed the head of the lion was revealed, and then other large fragments; for it had been broken up as is supposed wantonly to search for hidden treasure, the statue not being solid nor even originally carved from one block.

An account (probably by Cresy) which appeared in the *Literary Gazette* for 24th August 1824 thus describes it:—"A colossal lion's head of bold, beautiful workmanship. From the nose to the top of the head it measured 4 ft. 6 in., and from the forehead, where broken off just above the shoulder, 5 ft. 9 in. A part of the hind legs lay at some little distance, 2 ft. 3 in. in diameter, together with the other parts of the statue. The earth removed contained pieces of stone and cement that had formed a part of the foundation or pedestal on which it had been placed. It was not hewn out of one block, and it was not solid, but hollowed out for the sake of lightness."

Pausanias in his account says it had no inscription. The position of the beast is *sejant*, the expression calmly defiant, considering it commemorates a defeat. Mr. Taylor used all endeavours to get it removed to England, but they met with no success; and although the British Museum is so much the poorer, it is satisfactory to know that it is at length replaced upon its original site within view of Mount Parnassus, which is, however, twelve miles distant.

It was restored (upon paper) by M. Siegel (*Mon. Soc. Archeol. di Roma*, 1856, Tav. 1), and the general lines of the rectangular plain rustic pedestal he shows have been adopted, an extra plinth, however, added beneath the figure, and a necking and simple mould to the cornice omitted. I am unable to say whether actual fragments justify the design adopted, but its simplicity as compared with the tomb of Mausolus and other heroes is very decided.* As the want of relationship between statue and pedestal was made a strong plea for collaboration of architect and sculptor, any particulars in regard to this instance which our Hon. Corresponding Members could supply would be helpful. The theory that posture in human sculpture has been in ancient and mediæval times guided by definite geometrical angles might be put to the test in this case and in that of the more numerous instances of

* An illustration of the monument as now restored appears in *Black and White* of 13th May, taken from a French photograph.

lions *courant* which are in the national collection. The angles may be seen in regard to the human figure set out in Villar de Honnecourt's well-known sketch-book; and it would be interesting to know from experts whether this is accepted and employed in these days of "free art."

E. W. Hudson.

REVIEWS.

BUILDING SUPERINTENDENCE.

The Conduct of Building Work and the Duties of a Clerk of Works. By the late John Leaning. 2nd edition. [B. T. Batsford, 94 High Holborn, W.C.]

This is the second edition of the late Mr. Leaning's book published under the title given above. The first edition was issued in 1898, and was itself an amplified version of *The Duties of a Clerk of Works*, printed in 1887. Many additions have been made to the work for the present issue, the body of the book being extended from 99 pages in the previous edition to 128 in this, the appendix from 35 to 52, and the index from 14 to 25.

The work as it now stands is a general collection of notes upon matters connected with building contracts and with builder's work and its supervision, arranged as far as possible under trade headings. The idea of a handbook upon the duties of a clerk of works is not abandoned, although the notes especially applying to that part of the subject are interspersed with others which, useful though they may be as hints to the young architect, require more careful classification, and a certain amount of further editing to give them their full value.

Perhaps it would have been better to adhere to the original idea absolutely; in any case the scope of the present edition, which sweeps in matters pertaining to every stage of building work, from clearing the site and road-making to the opening ceremony and settlement of accounts, is so much more comprehensive than that of the earlier ones that an altogether larger volume seems to be suggested.

But these criticisms by no means condemn the book, which will deservedly be as popular as its predecessors: it is practical and useful, and its contents are rendered available by a full index.

Matt. Garbutt.

ALLIED SOCIETIES.

DEVON AND EXETER SOCIETY.

Fireplaces and Smoky Chimneys.

At a recent meeting of the Devon and Exeter Architectural Society the subject of "Fireplaces and Smoky Chimneys" was discussed. Mr. E. F. Hooper, who opened the discussion, divided his subject under the following heads:—(1) Badly constructed chimneys in favourable positions; (2) goodly constructed chimneys in unfavourable positions; (3) both; (4) open fireplaces, well-fires, and otherwise; (5) bad planning as to windows, doors, &c.; (6) stoves, grates, &c., which do not readily draw. To make a badly constructed chimney draw, he said, was very troublesome. The owner of a house some while ago spent 30*l.* in trying to improve a defective chimney. It was at last set right by a smith, who suggested a plain galvanised sheet-iron pot, resembling in shape the letter T, with two pipes at the end, stuck in the ordinary earthenware chimney-pot. A well-built chimney and flues in an unfavourable position—under a hill or high building, or near trees—is often a great nuisance. Open fireplaces which include a plain brick or stone opening, without any dog or other grate, seemed to be much in request, both in town and country. A plain, perforated iron grating was placed at the bottom, slightly elevated above the surrounding hearth. Well-fires appeared to be a matter of opinion. When adapting them to old buildings it was absolutely necessary to examine carefully the surroundings, as frequently on the removal of old grates, &c., mouse, rat and other holes take upon themselves the action of flues, which lead to disastrous results. The manner of planning was sometimes a very difficult one; at others it was very easy. Every site had its good and its bad sides, as also had the client, whose ideas often have to prevail, in spite of the professional knowledge brought to bear against the amateur suggestions. Some would have none but large airy flues, while others preferred them as small as possible. Mr. Hooper said that he himself favoured the latter, but he considered the forming of the "going" above the arch a very important one, the size and shape of which must not be lost sight of, especially in ranges.

NORTHERN ASSOCIATION.

The Report for the Forty-sixth Session of the Northern Architectural Association, just published, states that the roll of membership now stands as follows: Members, 78; Associates, 72; Students, 70. Total, 220. With the exception of the Manchester Society, this is the highest membership of any of the Allied Societies. The question of the incorporation of the Association under the Companies Acts is being considered by the Council. Thanks to the generosity of their Past President,

Mr. William Glover, the Association will shortly be housed in a home of their own at No. 6 Higham Place, Newcastle. Mr. Glover, it will be remembered, subscribed £1,000 towards a building for the Association, and the Building Committee have been fortunate in securing for that sum the premises mentioned. Members of the Association have been invited to contribute among themselves the £500 required to adapt the premises for their purposes. Mr. Glover has also recently presented the Association with a Presidential Chair in oak, with the arms of the Association carved on the back. In order to bring out the best work of their student members entering for the Institute Examinations, the Association have presented prizes this year for the best sets of Testimonies of Study prepared by them for the Intermediate and Final Examinations. The Council arranged for a course of six lectures on "Quantity Surveying" given by Mr. S. Addison Smith to members of the N.A.A. Students' Sketching Club. Seven essays were received in competition for the prize offered by Mr. A. B. Plummer for the best essay on "The Characteristics of Thirteenth-century Architecture, with special references to its Ornament and Mouldings." At the annual social gathering were exhibited the works prepared by students in competition for the Glover Travelling Studentship and other prizes of the Association.

The following are the Officers and Council for next Session:—*President*, J. T. Cackett [*F.*]. *Vice-President*, G. T. Brown. *Hon. Treasurer*, R. Burns Dick. *Hon. Librarian*, H. C. Charlewood [*F.*]. *Hon. Solicitor*, H. C. Harvey. *Hon. Secretary*, A. B. Plummer [*F.*]. *Members of Council*:—H. G. Badenoch, H. Barnes [*A.*], J. Bruce, F. Clark [*F.*], J. W. Dyson, C. S. Errington [*A.*], J. H. Morton [*F.*], J. Oswald [*F.*], F. Rich [*F.*], J. Spain [*A.*], J. W. Taylor [*F.*], J. W. Boyd, M. G. Martinson, A. K. Tasker, R. P. S. Twizell [*A.*], H. A. Wilson [*A.*].

MANCHESTER SOCIETY OF ARCHITECTS.

The following are the Officers and Members of Council for the ensuing Session:—*President*, J. H. Woodhouse [*F.*]. *Vice-Presidents*, C. H. Heathcote [*F.*], J. W. Beaumont [*F.*]. *Hon. Secretary and Treasurer*, Paul Ogden [*F.*]. *Assistant Hon. Secretary*, George Brown. *Members of Council*:—John Ely [*F.*], J. B. Gass [*F.*], E. Hewitt [*F.*], Jesse Horsfall [*F.*], A. H. Mills [*A.*], J. D. Mould [*F.*], Isaac Taylor, G. H. Willoughby [*F.*], P. S. Worthington, M.A. [*A.*], Godfrey Colles, A. E. Corbett [*A.*], J. H. Gibbons [*A.*].

LEEDS AND YORKSHIRE SOCIETY.

The following are the Officers and Council for the year commencing 1st May 1905:—*President*, G. Bertram Bulmer [*F.*]. *Vice-Presidents*, H. S. Chorley, M.A. [*A.*], W. G. Smithson [*A.*]. *Hon. Treasurer*, W. H. Thorp [*F.*]. *Hon. Librarian*, G. F. Bowman. *Hon. Secretary*, Robert P. Oglesby, 12 East Parade, Leeds. *Members of Council*:—Percy Robinson, T. Marshall [*F.*], F. Musto [*A.*], H. A. Chapman [*A.*], A. R. Hill [*A.*], G. E. Reason. *Past Presidents*:—J. W. Connon [*F.*], Henry Perkin [*F.*], W. H. Thorp [*F.*], E. J. Dodgson [*F.*], W. Carby Hall [*F.*], Butler Wilson [*F.*].

MINUTES. XIV.

At the Fourteenth General Meeting (Ordinary) of the Session 1904–5, held Monday, 15th May 1905, at 8 p.m.—Present, Mr. John Belcher, A.R.A., *President*, in the Chair, 28 Fellows (including 9 members of the Council), 34 Associates, 1 Hon. Associate, and visitors: the Minutes of the Meeting held Monday, 1st May 1905 [p. 456], were taken as read and signed as correct.

The President announced that Mr. William Beddoe Rees, *Associate*, of 3 Dumfries Place, Cardiff, had been expelled by the Council from membership of the Institute, under the terms of By-laws 22 and 23.

The following candidates for membership, found by the Council to be eligible and qualified according to the Charter and By-laws, were recommended for election:—As FELLOWS (37): Stanley Davenport Adshead; Robert Frank Atkinson; Harry Beswick (Chester); John Priestley Briggs; George Thomas Brown (Sunderland); Roger Thomas Conder [*A.*] (*Soane Medallist* 1881) (Buenos Aires); Eustace Lauriston Conder (Buenos Aires); Hubert Christian Corlette [*A.*] (*Owen Jones Student* 1896, *Institute Essay Medallist* 1899); Alfred Cox; James Bow Dunn (Edinburgh); Robert Evans, Jun. (Nottingham); William John Gilliland, President of the Ulster Society of Architects (Belfast); Francis Thomas Wilberforce Goldsmith [*A.*]; Ernest John Gosling; Arthur Ernest Heazell (Nottingham); Osborn Cluse Hills [*A.*]; John Hudson [*A.*]; John Hunt [*A.*]; Allen Trevis Hussell [*A.*] (Ilfracombe); Richard Macdonald Lucas (Southampton); Frederick William Marks [*A.*]; James Henry Martindale (Carlisle); Glendinning Moxham (Swansea); Sir Charles Archibald Nicholson, Bart., M.A. Oxon. (*Tite Prizeman* 1893); Frederick William Peel [*A.*]; Joseph Craddock Perkin; William Pywell [*A.*]; Charles Henry Rew (Great Berkhamsted); Edwin James Sadgrove; Thomas Arthur Sladdin (Cape Town); Frank Adams Smith [*A.*]; Professor Ravenscroft Elsey Smith [*A.*] (*Greek Travelling Student* 1888); Harry Teather (Cardiff); Frederick Wallen [*A.*]; William Williamson (Kirkcaldy); William Woodward [*A.*]; Alfred Bowman Yeates [*A.*]. As ASSOCIATE: Charles Thomas Palmer (*Probationer* 1898, *Student* 1900, *Qualified* 1904). As HON. ASSOCIATES (2): Edwin Austin Abbey, R.A., LL.D., F.S.A. (Fairford); William Goscombe John, A.R.A., Membre Correspondant de l'Institut de France. As HON. CORRESPONDING MEMBERS (2): Señor Don José Urioste y Velada (Madrid); Henri Paul Nénot, Architecte de la Sorbonne, Président de la Société Centrale des Architectes Français, Membre de l'Institut, Commandeur de la Légion d'Honneur (Paris).

A lecture on SCULPTURE IN ITS RELATION TO ARCHITECTURE was delivered by Mr. C. Stirling Lee, and a Paper on the same subject was read by Mr. W. Reynolds Stephens, whereupon a discussion ensued, and a vote of thanks was passed to the authors by acclamation and briefly acknowledged.

The proceedings then closed, and the Meeting separated at 10 p.m.